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Experimental Investigation on the Behaviour of Green Concrete with Waste Industrial by Products.

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ABSTRACT: The natural resources get reduce in a short period of time and therefore the recycling of waste product is necessary. There are numbers of old buildings and structures that are being destroyed today this debris is a good solution for production of green concrete.

Among all materials concrete is the main material for construction purpose, nowadays recycling of waste and industrial by-product gaining popularity to make concrete environment friendly materials and the concrete can be called as green concrete. Construction industry is growing rapidly and new technologies have developed very fast to cater different difficulties in the construction industry.

Concrete may have an important role to play to fulfill its obligation, agreed at the conference, to reduce the total CO2 emission. Recycled coarse aggregate (RCA) obtained from crushed concrete rubble and different demolished debris. Instead of being stored, it can be reused in the construction industry.

There is considerable knowledge about how to produce concrete without much impact on environment. However, it is not known to a sufficient degree, and with what technology, this "green concrete" can be applied in practice in buildings and structures. This paper gives an overview of the present state of affairs of concrete types that have reduced environmental impact, including the use of low energy cement, recycling of crushed concrete as aggregate, the use of fly ash micro silica, many more things this paper explains very clearly etc.

Keywords: Green Concrete, Demolished bricks. Micro silica recycled aggregate

I. INTRODUCTION

Green concrete is one of the major tools in the future when the natural resources are at the verge of extinction due to the eco-friendly nature. The Central Pollution Control Board India, has estimated the solid waste generation about 48 million tons per annum of which 25% from construction industry. The total amount of waste is produced approx 14.7 million tons every year in India. This waste can be used to produce new products and enhance the properties of concrete, also play a vital role in protecting environment [1].

Due to continuously mining the availability of aggregate has emerged problem in recent times, to overcome this problem aggregate has been replace by green concrete.

The green concrete is made with concrete wastes which are eco-friendly. Green concrete is a revolutionary experiment in the history of concrete industry [2]. The environmental problem induced from unsystematic disposal of municipal solid waste (MSW) is a real menace for the entire world. These wastes are increasing day by day due to population growth, wasteful and unsustainable resource use, urbanization, and industrialization.

The global construction industry uses billions tons of cement, aggregates (sand, gravel, and crushed rock) every year. The use of waste materials as a source of aggregate in new construction materials has become more common in recent decades because it has wider application in the construction industries due to its pozzolonic properties. The exhaustion of the existing landfills and natural resources encourage the use of aggregate to produce new concrete. Aggregate increases the strength of concrete.

The word "Green" does not represent the color, it is a concept of environment into concrete considering every aspect of the raw materials manufacture over construction, mixture design to structural design, and durability. Green concrete is very useful considered to be cheap to produce due in replace of recycled material whereby avoiding the charges for the disposal of waste, less energy consumption and greater durability [3].

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IMPACT ON ENVIROMENT DUE TO CONCRETE

1. A major component of concrete is cement that produces about 0.9 tons of carbon dioxide for every 1 ton of cement produced. Carbon dioxide is one of the greenhouse gases which are responsible for global warming.
2. Aggregates are mined from the rock mines and the rate with which concrete is produced there will be significant reduction in naturally occurring materials.
3. Disposal of construction materials and demolition wastes material has become a major problem these days, according to the report of Technology, Information, Forecasting, Assessment Council the total amount of waste from construction industry is estimated to be 12 to 14.7 million tons per annum. Because of increasing problems of these wastes many countries have started researches to use these materials as source [3].

WHY GREEN CONCRETE?

- Huge impact on sustainability
- Most widely used material on Earth
- In the planet, flow on 30% of all materials
- 70% materials flow in the environment.
- Greater than 2.1 billion tons per annum
- Greater than 15 billion tons poured each year
- Over 2 tons per person per annum

MATERIALS USED IN GREEN CONCRETE

There are many materials which are replaced in the green concrete with respect to the normal concrete which is being used in the structures of the skyscraper buildings. The few of the replaced material is provided below.

A. **Cement** -Eco-Cement, Sludge Ash, Municipal Solid Waste Fly Ash
B. **Coarse Aggregates** - Recycled Aggregates, Waste Ready Mix Concrete, Waste Glass, Recycled Aggregates With Crushed Glass, Recycled Aggregates With Silica Fume.
C. **Fine Aggregates** - Fine Recycled Aggregate, Demolished Brick Waste, Quarry Dust, Waste Glass Powder, Marble Sludge Powder, Rock Dust And Pebbles, Artificial Sand, Waste Glass, Fly Ash And Micro Silica, Solid Waste

1. Demolished bricks

Demolished bricks have collected from the demolished building of approx. age 50 years. The collected sample were broken manually into pieces of size passing through 4.75mm IS sieve and retained on 150 micron IS sieve [4].

Sr. No.	TESTS	STANDAND VALUES	OBTAINED VALUES
1.	SPECIFIC GRAVITY	1.80-2.0	1.96
2.	WATER ABSORPTION	28%-30%	30%

Table No. 1: Properties of Demolished Brick Wastes

2. Micro silica

Silica fume used confirming to ASTM – C (1240 – 2000) and was supply by "Elkem Industries" was name Elkem– Micro Silica 920 D. The silica fume is used as a partial replacement of cement [4].

Table No. 2: Properties of Micro Silica

Sr. No.	PROPERTIES	STANDARD VALUES
1.	Specific Gravity	2.2
2.	Bulk Density	576 (Kg/m^3)
3.	Size (Micron)	0.1-0.2

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3. Use of recycled aggregate

Construction and Demolition waste has emerged as a major problem in all over the world. In USA, approximately 120-135 million tons of Construction waste and Demolition waste is generated annually. Wastes have arising from construction and demolition materials one of the largest streams within the European Union and many other countries. Recycled demolished debris for use maximum environmental benefits. As a result recycling industries grew up. Many governments throughout the world have now introduced various measures aimed at reducing the use of primary aggregates and encouraging reuse and recycling, where it is technically, economically, or environmentally acceptable. Recycling construction industries in many parts of the world that have converts low value waste into secondary construction material such as road materials and aggregate fines. The gap between these interests has to be reduced in steps that are manageable and the use of RCA in structural concrete has to be promoted gradually. Attention is required to the control of waste processing and subsequent sorting, crushing, separating and grading the aggregate for use of the eco green concrete in construction industry. There is an urgent need for legislative or regulatory measures to implement sustainable Construction & Demolition waste management strategy and encourage recycling for use in value added applications.

a. It has been reported that there is a loss in compressive strength of concrete when recycled aggregates are used for production of concrete as direct replacement to natural aggregates.
b. Therefore it can be used as partial replacement to natural aggregates.
c. The lower compressive strength recorded for concrete produced with recycled aggregate was due to higher water cement ratio, which was required to facilitate mixing due to absorption of the recycled fine particles.

Figure 1 – Coarse & Fine Agregates

4. Use of quarry dust

River sand has expensive from natural sources. These sources induced environmental problems. As environmental transportation and other constraints make the availability and use of river sand less attractive, a substitute for this material in concrete industry needs to find. River sand is mostly used fine aggregate to make concrete poses the problem of acute shortage in many areas in India .In this situation the Quarry rock dust can use a economic to the river sand. Quarry Rock Dust is used in the highways as a surface coat and also used for construction of hollow blocks.

In the recent past good attempts have been made for the successful utilization of various industrial by products (such as fly ash, silica fume, rice husk ash, foundry waste) to save environmental pollution. Natural aggregates in concrete have gained good attention by adding of these material. Quarry dust in conventional concrete. The uses of Quarry rock dust has been accepted as a building material in the industries.

5. Uses of Wastes

Instead of a Portland cement mix, green concrete uses from 25 to 100 % of fly ash. Fly ash have produced by coal combustion and has collected from the chimneys of industrial plants .

WAYS TO PRODUCE GREEN CONCRETE

In three different development projects in the center, green concrete is examined in three different ways:

1. To reduce the clinker content, in cement with fly ash, micro silica by using Portland limestone cement. The preliminary plan is to analyses concrete for passive environmental class with fly ash amounts of up to 60% of the total amount of cement.
2. To develop new green cements and binding materials, rapid fast hardening low energy cemented based on mineralized clinker has currently ready for testing.
3. Concrete has utilized inorganic residual products (stone dust, crushed concrete as aggregate in quantities and for areas that are not allowed today) and cement stabilized foundation with waste incinerator slag, poor quality fly ash or other inorganic residual products. The products has explained by origin, particle size and geometry, chemical composition and possible environmental impacts. From this information- screening

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approximately 5 products will be selected and analyzed for use in green concrete.

ENVIROMENTAL BENEFITS USING GREEN CONCRETE

Geo polymer concrete, or green concrete, is part of a movement to create construction materials that have a reduced impact on the environment. This has made from a combination of an inorganic polymer and 30 to 100 percent industrial wastes. Following list of 4 benefits to using green concrete for our research project.

1. Lasts Longer

Green concrete increase strength faster and has a lower rate of shrinkage than concrete made only from opc. These has a greater resistance to corrosion which is important with the effect pollution has had on the environment (acid rain greatly reduces the longevity of traditional building materials). Construction materials have needed and the impact effect to the environment during the process of making those materials is reduced.

2. Uses Industrial Waste

100 percent of ordinary Portland cement mixture, green concrete uses anywhere from 30 to 100 percent fly ash. Fly ash is part of coal combustion and is gathered from the chimneys of industrial plants that use of coal as a power source. Hundreds of thousands of acres of land are used to dispose of fly ash in India.

2. Reduces Energy Consumption

If less Portland cement and more fly ash have used during mixing concrete, then less energy is produced. Portland cement required huge amounts of coal or natural gas to heat it up to the appropriate temperature to turn them. Fly ash has already used as a byproduct of another industrial process so you are not expending much more energy to use it to create green concrete.

3. Reduces CO2 Emissions

In order to make Portland cement–one of the main ingredients in ordinary cement–pulverized limestone, clay, and sand are heated to 1450 degrees Celsius using natural gas or coal as a fuel. Approx 5 to 8 percent of all carbon dioxide (CO2) emission worldwide due to production of cement. Eco green concrete has releases CO2 emissions up to 80 percent fewer. Reduce emissions and switching over completely to using green concrete for construction.

ADVANTAGES OF GREEN CONCRETE

- Green concrete gains strength faster and has a lower rate of shrinkage than concrete made only for Portland cement.
- Reduces environmental pollution.
- It reduces the consumption of the energy.
- It also reduces the emission of the carbon dioxide in the environment.
- Reduces the consumption of cement overall.
- Green concrete is economical compared to conventional concrete.

DISADVANTAGES OF GREEN CONCRETE

- The availability of the material used in green concrete is lesser.
- They cannot be used in hot areas since it does not have the air cooling feature such as ventilations.
- When compared to conventional concrete, compressive strength and other characteristics are less.
- Water absorption of the green concrete is high.
- Shrinkage and creep are high compared to conventional concrete.
- Flexural strength is less in green concrete.

II. CONCLUSION

The overview of the present state of affairs of concrete types with reduced environmental impact has shown that there is considerable knowledge and experience on the subject. The environmental policies have motivated the concrete industry to react, and will probably also motivate further development of the production and use of concrete with reduced environmental impact.

Green concrete having reduced environmental impact with reduction of the concrete industries CO2 emissions by up to 30%. It is having good thermal and fire resistant. This type of concrete recycle use of waste material such as ceramic wastes, aggregates, so increased concrete industry use of waste products by more than 20%. Hence green concrete consumes less energy and become economical and it is also beneficial for human beings.

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