WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Research on Green Concrete

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A B S T R A C T

Green Concrete is that type of concrete that is used to create the construction materials having a lesser effect on the environment. This version of concrete is made up from the mix of the industrial waste and inorganic polymer. The most commonly way to produce green concrete is by using the industrial waste products such as fly ash, blast furnace slag, and cement mixture. This means concrete that uses less energy in its production & produces less carbon dioxide than normal concrete is green concrete. It has many advantages such as reduction in shrinkage & creep, green Concrete uses local and recycled materials in concrete and the heat of hydration of green concrete is significantly lower than traditional concrete. The green concrete is used in the dam, bridges, buildings, columns, hut and much more. Among all materials used in the construction industry concrete is main material for construction purposes. Billions of tons of naturally occurring materials are mined for the production of concrete which will leave a substantial mark on the environment. Nowadays recycling of waste and industrial by products is gaining popularity to make concrete an environment friendly material and this concrete can be called as Green Concrete. This review paper will give us a brief idea about advantages and disadvantages of green concrete.

Keywords: **Concrete, Green Concrete, Replacement materials**

Introduction

Concrete which is made from concrete wastes that are eco-friendly are called as “Green concrete”. Green concrete is the production of concrete using as many as recycled materials as possible and leaving the smallest carbon footprint as possible. The other name for green concrete is resource saving structures with reduced environmental impact for e.g. Energy saving, co2 emissions, waste water. “Green concrete” is a revolutionary topic in the history of concrete industry. This was first invented in Denmark in the year 1998 by Dr. WG. Concrete wastes like slag, power plant wastes, recycled concrete, mining and quarrying wastes, waste glass, incinerator residue, red mud, burnt clay, sawdust, combustor ash and foundry sand. Green Concrete is a term given to a concrete that has had extra steps taken in the mix design and placement to insure a sustainable structure and a long-life cycle with a low maintenance surface e.g. Energy saving, CO2 emissions, waste water. The goal of the Centre for Green Concrete is to reduce the environmental impact of concrete. To enable this, new technology is developed. The technology considers all phases of a concrete construction’s life cycle, i.e. structural design, specification, manufacturing and maintenance, and it includes all aspects of performance, i.e. 1) Mechanical properties (strength, shrinkage, creep, static behavior etc.)

2) Fire resistance (spalling, heat transfer etc.)

3) Workmanship (workability, strength development, curing etc.)

4) Durability (corrosion protection, frost, new deterioration mechanisms etc.)

5) Thermodynamic properties (input to the other properties)

6) Environmental aspects (CO2-emission, energy, recycling etc

OBJECTIVE

- To reduce greenhouse gas emissions, i.e., carbon dioxide emissions from the cement industry.
- To reduce the usage of pure resources such as limestone, clay, shale, natural river sand, natural rocks that are being used to making conventional concrete.
- Also, to reduce the wastage of materials in the concrete leading to air, land, and water pollution.
- It has sufficient strength and durability in comparison with standard concrete.
- Also has distinctive resistance to corrosion and also effectively prevents acid rain.
- Buildings made of green concrete use less energy because they are more resistant to temperature changes, thus saving heating and cooling costs.
- Transferring this concrete for construction reduces the effect of global warming to some extent

METHODOLOGY

- **Specifications**
- M25 Grade concrete
- Water cement ratio = 0.45
- Coarse aggregate of 20mm size(1600kg/m3)
- Fine aggregate (Dry sand 1600kg/m3)
- Cement – OPC (Grade 45) (unit weight- 1440 kg/m3) \
- Glass Fly ash (from NTPC power plant, Dadri)

- **Apparatus**:
- Cube Mould (150x150x150 mm or 100x100x100 mm)
- Tamping bar (16 mm diameter and bull-nosed)
- Steel Float/Trowel.
- Compressive strength Testing machine
- Curing Tank
- Weighing machine
- Pan
- Hammer
- Cylindrical mould
- Sieving machine

- **Procedures of Making Concrete Cube:**
- 1. Cleaning &fixing mould
- 2. Breaking of Glass
- 3. Mixing cement, glass and Fly ash.
- 4. Placing, Compacting & Finishing concrete

- 5. Curing

ACCEPTANCE CRITERIA FOR CONCRETE

As per 16.1(a) /IS 456/2000 (pg 30*)*:-

For all Concrete > M15 Grade and above

The average strength of four (4) non-overlapping consecutive test result shall not be less than –

For M15 or higher:

f average ≥ (fck + 0.825 Õ)
N/mm2 orf average ≥ (fck + 3)
N/mm2 (Whichever is more)

As per 16.1 (b)/IS456/2000 (pg 30*)*

Individual test result of any sample ITR ≥ (fck – 3) N/mm2

As per 15.4 of IS456/2000 (pg 29)

The test result of the sample shall be average of the strength of three specimen and the individual variation shall not be more thanthat of the Average strength, if more the test result of the sample are Invalid.

ITR Value is 22

RESULTS AND DISCUSSION

Whenever 28 days of curing was finished than (150 mm X 150mm) blocks were tested in CTM machine.

COMPRESSIVE STRENGTH TEST READING

- Following results were obtained
- **Test result when cement is 15% replaced by glass**

	Compressive strength at 14 days	**Converting Into 28 days(Col.B/0.9)**	**Average Compressive Strength (N/mm$^{2)}$**
First cube	26.89	29.87777778	
Second cube	30.01	33.34444444	33.864
Third cube	32.01	35.56666667	
Fourth cube	33	36.66666667	

Test result when cement is 30% replaced by glass

Cube	**Compressive strength at 14 days**	**Converting Into 28 days(Col.B/0.9)**	**Average Compressive Strength (N/mm$^{2)}$**
First cube	22.14	24.6	**26.44**
Second cube	25.3	28.111	
Third cube	28.22	31.356	
Fourth cube	30.1	33.444	

Test result when cement is 45% replaced by glass

Cube	**Compressive strength at 14 days**	**Converting Into 28 days**	**Average Compressive strength (N/mm$^{2)}$**
first cube	20.5	22.7	**24.7**

Second cube	21.6	24	
Third cube	22.89	25.4	
fourth cube	24	26.66	

Test result when cement is 15% replaced by glass and fly ash

Cube	**Compressive strength at 14 days**	**Converting Into 28 days**	**Average Compressive strength (N/mm$^{2)}$**
first cube	31.55	35.06	
Second cube	33	36.667	37.297
Third cube	34.5	38.33	
fourth cube	35.22	39.133	

Test result when cement is 30% replaced by glass and fly ash

Cube	**Compressive strength at 14 days**	**Converting Into 28 days**	**Average Compressive strength (N/mm$^{2)}$**
first cube	23.5	26.11	
Second cube	26	28.89	28.889
Third cube	26.5	29.44	
fourth cube	28	31.111	

Test result when cement is 45% replaced by glass and fly ash

Cube	Compressive strength at 14 days	Converting Into 28 days	Average **Compressive strength (N/mm$^{2)}$**
first cube	19.8	22	
Second cube	21.2	23.556	24.208
Third cube	22.6	25.11	
fourth cube	35.55	26.167	

Average Test result when cement is 15%, 30%,45% replaced by glass

S. No.	**Percentage replaced**	**Compressive strength (N/mm$^{2)}$**
1	15%	33.863889
2	30%	26.44
3	45%	24.71

Average Test result when cement is 15%, 30%, 45% replaced by glass and fly ash

S. no.	**Percentage replaced**	**Compressive strength (N/mm$^{2)}$**
1	15%	37.297
2	30%	28.889
3	45%	24.208

CONCLUSION

In this article, we have studied about the green concrete like properties, advantages, disadvantages, etc. With the help of Green Concrete, we can save the natural materials for future generations. Green Concrete Technology is one major step in construction industry to achieve sustainable construction. It is cost effective. There is significant potential in waste materials to produce green concrete. The replacement of traditional ingredients of concrete by

waste materials and by products gives an opportunity to manufacture economical and environment friendly concrete. Partial replacement of ingredients by using waste materials and admixtures shows good compressive and tensile strength, improved sulphate resistance, decreased permeability and improves workability.

The tests were conducted and the observed values are concluded as follows:

- We can replace cement by glass securely up to 30%and little more but we cannot replace it by 45 % & more.
- We can replace cement by (glass + fly ash) up to 30% but we cannot replace it by 45 % & more.
- 28 days strength Acquire from (glass + fly ash) is more than 28 days strength of glass replacement.
- On strength, criteria by glass + fly ash replacement is better than by only glass-replacement.

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