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Green Concrete: Environment Friendly Solution

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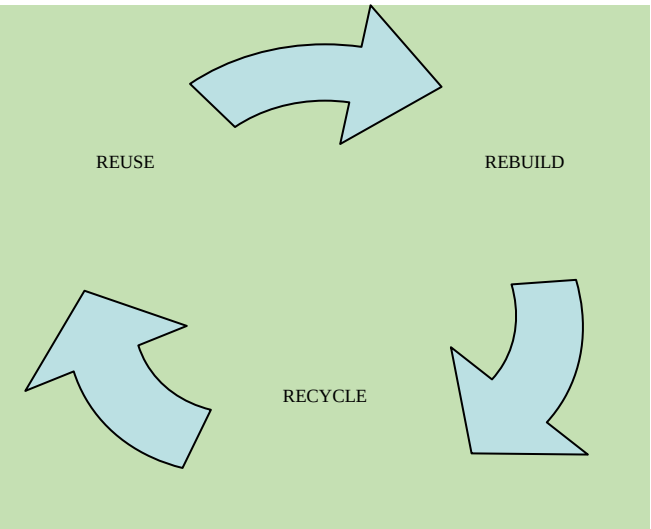
Abstract: ***Green concrete is a type of concrete. It is a sustainable material used for the construction of reinforced concrete structures. Green concrete is different compared to normal concrete. Nowadays, it plays a very good role in the construction of structures. It is subjected to very low energy consumption and low resource consumption. Green concrete is a very good material for sustainable development. Concrete is made from the replacement of substituent ingredients such as cement and aggregates. In this waste materials such as agricultural or industrial wastes are placed during manufacture to produce a new concrete. Green concrete is popular worldwide due to its extraordinary properties and applications. This paper mainly deals with the importance of green concrete and its applications, advantages, and disadvantages. The results are varying for based on different structures. So, we can get all characteristics and properties of concrete structures and know their strength.***

Keywords: Green concrete, sustainable material, Recycled aggregate.

I. INTRODUCTION

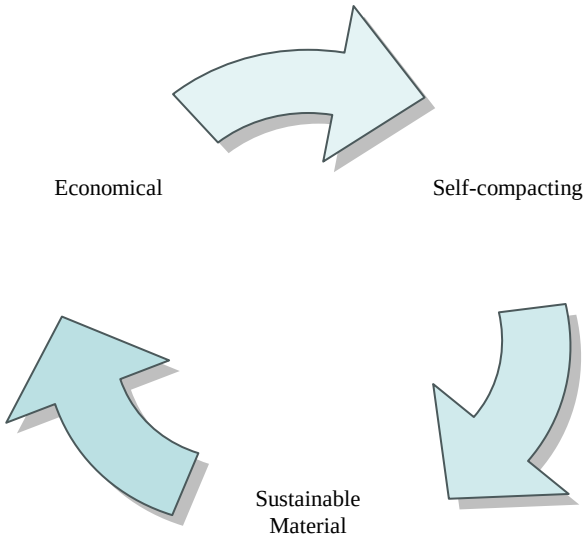
Green concrete is a good material for construction and sustainable material. It is first used in Denmark. Concrete is made with concrete waste. Green concrete is a good material used in construction, which does not produce any harmful agents to the atmosphere and plays a good role in the eco-friendly construction of buildings, structures, etc. The concrete is made from cement, sand, gravel, and fly ash. These are mixed with water to form a good bonding material. The difference between normal concrete and green concrete is environmentally friendly, and reuse and reconstruction materials are made from waste materials. Normal concrete is not an environmentally friendly material. Green concrete can be used for any structure easily. Normal concrete is subjected to carbon emissions, but green concrete is not. It is the major advantage and reason for using green concrete over the world. This can be resistant to greenhouse gases and environmental pollutants etc. the main reason for existing green concrete is the reduction of carbon emissions in the environment. To free pollutants from the environment. It is one of the important technologies in concrete development in history. Because the world's landfills are rapidly filling up with trash that might be Recycled, it's past time to create and utilize sustainable building materials.

Building future sustainable green cities may be very difficult since cities must minimize their environmental impact by using eco-friendly materials, conserving resources and energy.



Advantages

Green concrete is the most recent advancement in construction technology, providing a long-term, environmentally friendly building material. Green concrete is a concept that involves partly or completely replacing cement with different elements that are either by-products of other materials' manufacturing processes or recovered trash. Green concrete has a lot of advantages compared to normal concrete. In this, we can discuss few important advantages. They are listed below.



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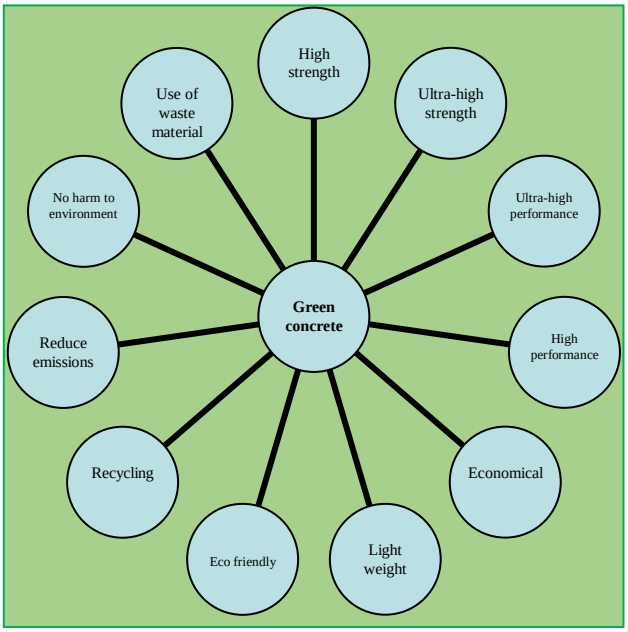
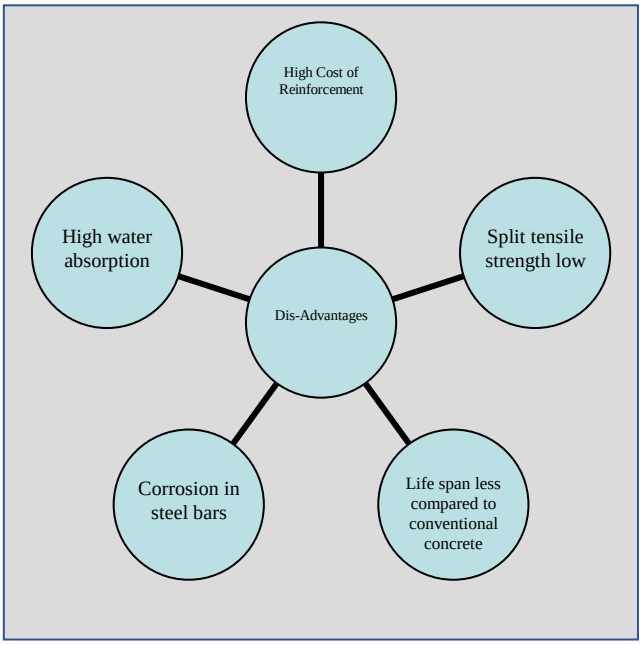


Dis Advantages

Every material has an advantage and some disadvantages too. Cement production emits approximately 8%–10% CO_2 and raises global temperatures. In this, green concrete is also subjected to some disadvantages. They are as follows;



Substitutes for production of green concrete

In this, there are two types of wastes used for making green concrete. They are given below;

Wastes from industries

- Silica fume
- GGBS
- Fly ash
- Surkhi

Wastes from agriculture

- Rice Husk Ash
- Metakaolin

Fig.1 Substitutes of Green Concrete

Recycled Aggregates

The following are some of the green concrete materials. They are as follows;

Fig.2 Waste materials

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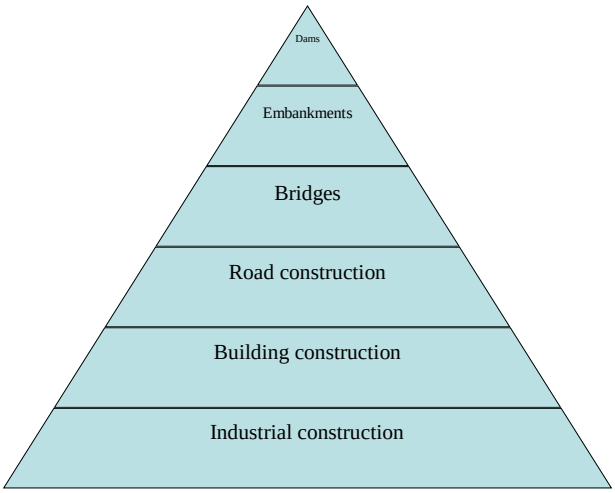
II. LITERATURE REVIEW

Author	Year	Research Findings
Karma Wangchuk	2013	In every kind of building, there are many options for material selection. Engineers and architects are being encouraged to use more sustainable materials due to the increasing interest in sustainable building. Green concrete, which is suitable for long-term building, is distinguished by industrial wastes to minimize natural resource and energy consumption and pollution of the environment. Green concrete is more environmentally friendly since it replaces materials that would otherwise be used in conventional concrete.
Glavind	2002	Denmark's commitment to decrease CO2 emissions by 21% below 1990 levels by 2012, as promised at the Kyoto and Bonn Conferences, is dependent on cement and concrete. It is also feasible to utilize leftover products while keeping a high level of concrete quality, minimizing the need to dump these materials. To achieve environmental benefits, it is necessary to consider the full life cycle of a concrete building. This emphasizes the importance of working together as a team. The Center for Green Concrete was established to accomplish this goal. For all stages of concrete structure design, building, and usage, new technology is being created. So far, the results show that the established environmental objectives will be met.
Thomas	2016	Due to the environmental issues caused by waste tyre rubber, new environmentally friendly concretes such as rubberized concrete are being pushed forward. Thousands of millions of tyres are abandoned, thrown away, or buried every year across the globe, posing a significant environmental concern. The potential of waste tyre rubber particles as a partial replacement for fine aggregates in standard and high strength cement concrete and their abrasion resistance is investigated in this research. To reinforce the findings of the experiments, statistical analysis was carried out. The findings indicate that using tyre rubber particles in concrete may enhance its abrasion resistance, allowing it to be used in pavements, floors, concrete roads, and other applications where abrasive forces exist between surfaces and moving objects.
Siddique	2018	To accomplish sustainable building, it is critical to reuse waste resources for construction materials. The use of waste materials as building materials helps preserve the environment, but it also saves money. The strength and durability of green concrete produced using SFS as a sand substitute are also discussed. SFS was used to replace natural sand in concrete at weight replacement values of 0, 5, 10, 15, and 20%. Strength improvements of up to 26 percent and 12.87 percent above control concrete after 28 days, respectively. Similarly, SFS-treated concrete mixes had reduced chloride ion penetration and improved salt scaling resistance by 7.2–17.7% and 6.6–26.42 percent, respectively.
Maraveas	2020	The construction industry has many difficulties in contemporary times, mainly due to rising urban populations and diminishing natural resources that enable the manufacturing of building materials. The materials were chosen primarily based on their popularity and widespread usage in contemporary building applications. Furthermore, the emphasis of this study is on finding alternative methods to developing sustainable building materials.

Duxson	2007	Inorganic polymers (also known as "geopolymers") are addressed in terms of their potential role and drivers in the quest for more sustainable concrete industry. It is generally acknowledged that several problems prevent broad use of geopolymer technology. They were challenging to comply with. Work on addressing these problems continues, with accelerated durability testing indicating that salt scaling and freeze-thaw cycles can be overcome. Their detrimental impacts on concrete performance are given special emphasis, implying that a better knowledge of geo polymerization chemistry is required for the technology to be effectively implemented. In contrast to Portland-based cement, the connection between CO2 footprint and composition is calculated.
Sadek	2012	Population growth, urbanization, and industrialization all led to a rapid depletion of natural resources and the production of significant trash. Unless they are shown to be hazardous via testing, waste recycling in the concrete industry will result in greener and more sustainable concrete. It provides a solution to the difficulties associated with its disposal while also adding changed characteristics to the concrete. In general, ACS-containing concrete performed better than concrete composed solely of natural aggregates. Furthermore, using ACS in concrete with RCA reduced the detrimental effects of RCA on concrete strength and durability without increasing the cement amount.
Liew	2017	countries' aim to decrease greenhouse gas emissions, the need to conserve natural resources, and limited landfill space has contributed to the rise in demand for green concrete. Green concrete comes in a variety of forms. Cracking is just a few of the many environmental, technical, and economic advantages of green concrete. These features encourage quicker concrete production, shorter curing times, lower construction costs.
Kim Hung	2016	The increasing use of concrete has resulted from the growing demand for buildings throughout the globe. On the other hand, conventional concrete-making materials are not completely environmentally friendly, prompting research into greener concrete alternatives. Extensive study has been done to use agricultural waste materials. the results show that such resources may be used in concrete. Reusing agricultural waste materials in concrete may decrease reliance on traditional concrete-making resources while also reducing environmental impact. Materials are conducted in this article to evaluate the advantages and drawbacks of utilizing these materials. The use of agricultural waste materials reduced certain concrete characteristics, effective treatment techniques, and waste material selection would allow for concrete with better performance. This paper's overview and discussion should offer fresh information and understand a wider range of agricultural waste materials utilized to make greener and more sustainable concrete.
Golewski	2018	Green buildings are now an essential component of ensuring sustainability, and concrete composites containing FA may undoubtedly be incorporated in green concrete. To minimize the environmental danger posed by FA waste disposal and decrease cement use, effective marketing of green concrete that incorporates FA is needed. The impact of age of concretes treated with FA addition on the parameters studied was evaluated during the testing. The tests were carried out after 3, 7, 28, 90, 180, and 365 days of cure. Stress intensity variables have been found to have crucial levels. The characteristics of composites containing FA are affected by the concrete's age at the time of testing.

III. APPLICATIONS



Green concrete dam

Green concrete bridges

Green concrete building

Green concrete column

Hungry horse dam

Rihand dam

IV. GREEN CONCRETE IN THE CONSTRUCTION OF STRUCTURES AND SUITABILITY

Reasons for the need for green concrete

Green concrete is similar to normal concrete, but the difference is that we are introducing two more materials as a partial replacement for cement and coarse aggregate and that materials are recycled aggregates and fly ash. Generally, recycled aggregates are obtained from construction waste that includes concrete waste, brick wastes, and reinforcement, etc. concrete waste can be used for recycled aggregates in construction.

There are some important points for the suitability of green concrete in structures. They are as follows;

- Reduce dead load on the structure
- Reduce overloading in the structure
- Good resistance to fire and insulation
- Reduction of carbon dioxide around 30%
- waste usage increase
- Less maintenance and repairs

V. MATERIAL PROPERTIES

The performance and cost of the components would be used to determine which materials to use in the concrete mix. Following are some of the material properties of green concrete.

Cement

S.No.	Test	Results
1	Specific gravity	3.10
2	Fineness	4.0

Fine aggregate

S.No.	Test	Results
1	Specific gravity	2.5
2	Fineness	3.2
3	Water absorption	0.5

Coarse aggregate

S.No.	Test	Results
1	Specific gravity	2.5
2	Aggregate crushing	14
3	Aggregate impact	6.0

Recycled aggregate

S.No.	Test	Results
1	Specific gravity	2.70
2	Water absorption	0.15

Fly ash

S.No.	Test	Results
1	Specific gravity	2.01
2	Fineness	2.7

Air content

S.No.	Max. size of aggregate (mm)	Air content
1	10	1.4
2	20	1.0
3	40	0.7

Water content

S.No.	Max. size aggregate (mm)	Water content per m^3 of concrete (Kg)	Sand (%)
1	10	201	39
2	20	180	32
3	40	160	29

VI. TESTS & RESULTS

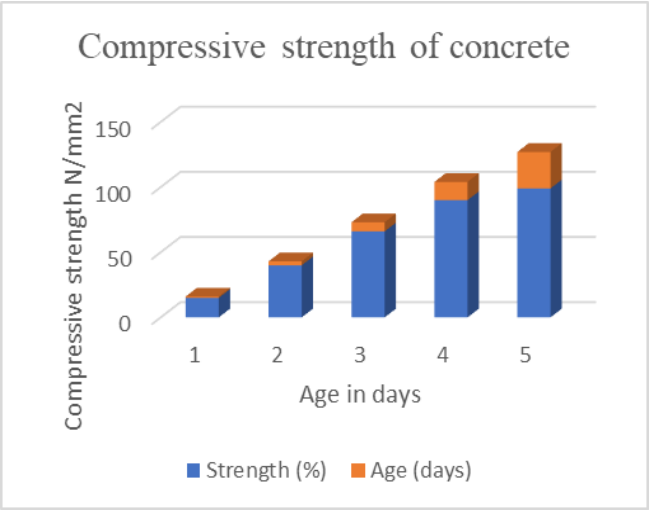
Compressive strength

This test is conducted on concrete to know the load-carrying capacity of concrete without any cracks and deflections in the concrete. A cube test is conducted to know all about the characteristics of concrete. The strength of concrete varies from 20 to 30 maps depending on the structural strength will vary. Compression leans towards reducing the size. Size of cubes 15x15x15cm is used.

Compressive Strength = Load / Cross-sectional Area

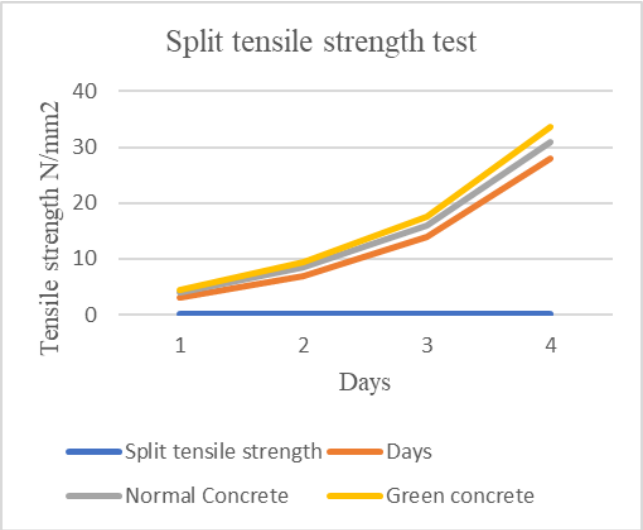
Fig.3 Mould

Strength (%)	Age (days)
15	1
40	3
66	7
90	14
99	28



Tensile strength

A tensile strength test is conducted to know the ability of the material to withstand the tensile loads. So, tensile strength tests are used to elongation of materials and their properties as well.



VII. CONCLUSION

Green concrete is a good material for concrete structures. It gives very good strength and durability to the concrete structures.

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Compared to conventional concrete, it gives good workability under any condition to the concrete structures. Nowadays, a lot of research is going on concrete to increase its durability and strength aspects and decrease and avoid unnecessary problems to the environment. Now we got an excellent bonding material in the form of green concrete. The color of concrete is green, and it represents eco-friendliness to the environment. My final words to the conclusion of green concrete are reuse, recycle, rebuild the concrete structures.

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