

A Study on Green Concrete

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Abstract: The concrete made by the eco-friendly industrial waste products is called as Green Concrete. This concrete has better performance and cycle sustainability. This technology is result of various efforts that have been conducted by researchers to reach at some alternatives that effectively are able to reduce high energy consumption and drastic environmental impacts during the production of cement. The production of green concrete does not alter the environment. The concept of green concrete comes under sustainable development. This concept of green concrete reduces the consumption of natural resources and energy. This idea of green concrete is quite new, developed to reduce the effect on environment during production process of cement. The manufacturing of cement results to emission of about 10 percent of the world's total carbon dioxide. Therefore by replacing the cement by various materials which are not harmful for environment such as fly ash reduce the problem of disposal of these industrial wastes. This review paper gives us a definite idea of advantages and disadvantages of green concrete.

Keywords: Green concrete, Marbles sludge powder, Recycled aggregate, Quarry dust, Silica fume.

1. Introduction

The word "Green Concrete" indicates its environmental sustainability and eco-friendliness and does not refer to the green appearance of the concrete. This concrete is made with eco-friendly concrete wastes so called as green concrete. The increased rate of construction nowadays increases the demand of material to be used for the construction. Since aggregates are the main constituent of concrete. Therefore, the excessive use of aggregates increases the pressure on natural resources. At present times the cost of the aggregates is very high and are not easily available, so by replacing the aggregates by suitable non-bio-degradable and eco-friendly industrial wastes solve the problem of non-availability and high cost of aggregates. This technique reduces the problem of disposal of these industrial wastes. Cement is also one of the main constituent of concrete. The manufacturing process of cement results the emission of about 8 to 10 percent of worlds total carbon-dioxide. when the ingredients of cement, limestone and clay is crushed and heated at a temperature of about 1500 degree centigrade to produce cement, global warming gas is released. So to avoid these big problems, Green Concrete is brought into practice. Green Concrete reduces the emission of carbon-dioxide up to 30 percent and saves energy, also reduces the pressure on natural

resources to some extent. Green concrete plays a vital role in prevention of environment and natural resources. The constituent of this concrete does not respond to carbon footprint and give healthy environment to all.

Architects and engineers are strongly motivated to choose the ingredients that are more effective in achieving sustainability in the field of construction. Environmental impact is minimized by the selection of material of concrete. Production of "Green Concrete" is cheaper.

2. Objectives

- To reduce the emission of carbon-dioxide, green concrete is used.
- To make the best use of the non-bio-degradable industrial wastes.
- One of the objective of green concrete is to reduce the cost of the concrete.
- To create sustainability in the field of construction.
- To study the compressive, flexural and tensile strength of concrete with constituents of cement as silica fume, quarry rock dust, etc. instead of limestone and clay.

3. Literature Review

In 2012, N. K. Amudhavalli et al concluded that the most important constituent of concrete is Portland cement. The cost of Portland cement very high and is versatile. It is a versatile and relatively high cost material. Large scale production of cement is causing environmental problems and depletion of natural resources. This paper represents the detail experimental study on compressive strength, flexural strength and split tensile strength. Consistency of cement depends upon its fineness.

Durability of concrete increases by addition of silica fume in proper proportion from acidic water attack and maintains concrete condition.

Garg and Jain (2014), studied on green concrete: efficient & eco-friendly construction materials. In future green concrete will reduce the emission of CO₂ in environment and minimize the environmental problems. Also the production cost of green concrete is low as compared to ordinary concrete.

In 2015, Arun Borsaikia, studied about the silica fume & its

properties and comes to the conclusion that various parameters of both fresh and hardened concrete are getting changed due to silica fume content. Following conclusions can be made. 1. Addition of silica fume up to certain limit improves workability of concrete. 2. At certain specified limit replacement of cement by silica increases comprehensive strength of concrete. 3. Ultrasonic Pulse Velocity increases with increase in compressive load initially and the decreases with increase in compressive load due development of micro cracks in concrete. In 2016, Praveer Singh, et al after studying about silica fume he concluded that increased usage and demand of cement at present times, cement has become a vulnerable resource all over the world. silica fume as a pozzolana material is rapidly used. Silica fume improves both the fresh and hard properties of concrete when mixed in suitable and proper proportions. Adding of silica fume in proper proportion improves durability attack by acidic waters. The condition of the concrete gets improved by the involvement of silica fume.

4. Raw Materials Used in Green Concrete

A. Fly Ash

Fly Ash is a heterogeneous bi-product material and is the best and suitable alternate for the limestone and clay as an ingredient in concrete. It is the finely divided residue formed by the combustion of powdered coal in industries. It is transported by flue gases and is collected by the process of electrostatic precipitation. In India around about 5% of fly ash is used in concrete. The Portland cement concrete is used in a big way as building material. Some inherent disadvantages of portland cement are complex to reduce because of restrictions of production process and raw material. 75 million tons' volume of silica fume is produces every year and the disposal of which becomes a major concern all over the world.

B. Marble sludge powder

This needs a threadbare revise on track and means of giving shelter and infrastructure for the society. the waste like marble sludge is used to reduce the use of natural resource, energy and pollution of the environment. Usage of cement reduces 14-20% by using waste material like marble sludge powder. Green concrete is capable for sustainable development.

C. Quarry rock dust

Quarry rock dust is defined as a non-usable waste material after obtaining and processing of rocks form fine particles, less than 4.75mm. The quarry dust particles are rough, angular and sharp, which results increase in strength because of efficient interlocking. Quarry rock dust is formed during blasting, crushing and screening of coarse aggregates. The durability of quarry rock dust is good as compared to ordinary concrete. Permeability of Quarry rock dust concrete gives better results also sulphate and acid resistance is less.

D. Recycle aggregate

The physical and mechanical properties of recycled coarse

aggregates are found to be of low quality. To improve the quality of coarse aggregate we need to wash the aggregates to remove old mortar stick to the surface of the aggregates. The engineering properties of hardened concrete are found to be improved after the use of recycled coarse aggregates. The compressive strength of the hardened concrete containing 100% washed recycled aggregates after 28 days was slightly at the lower side. Compressive strength after 28 days get reduced by 7%.

E. Ground granulated blast furnace slag

It is an excellent adhesive material having the properties of cement to some extent. Slag is obtained by crushing the iron in liquid form. It is a by-product of iron and steel making from a blast furnace in water or steam during the process of making a glassy product which is then dried and converted to a fine powder. Heat of hydration of ground granulated blast furnace slag is low, similar to fly ash.

5. Impact On Environment Due to Concrete

During the production of 1 ton of cement, it is observed that 0.9 tons of carbon-dioxide is released. Burning of limestone and clay at about 1500 degree centigrade to produce cement, results the emission of green-house gases. One of the main ingredient of concrete is aggregates. It is impossible to have concrete without aggregates. The disposal of constructional wastes (demolished construction etc.) is a major problem. According to council of technology information forecasting assessment, per annum amount of waste from the construction industry is estimated to be 12 to 14.7 million tons. Out of which 7.8 million tons are concrete and brick waste. The disposal problem of these wastes led to many research and idea of green concrete is evolved.

6. Environmental Benefits to Using Green Concrete

Green concrete, or geopolymer is a part of created material which has found to less impact on the environment. Uses industrial waste. Instead of a 100% portland cement mixture uses anywhere from 25 to 100% fly ash and is made from a combination of an inorganic polymer.

7. Advantages of Green Concrete

- Reduces the emission of carbon dioxide upto 30% as compared to ordinary concrete.
- Green concrete gain strength much faster and reduces the hydration rate.
- Green concrete is corrosion resistant and is strong enough against the acidic attack.
- By using green concrete the consumption of cement is lowered overall.
- The land can be saved for other purpose by using fly ash in green concrete.
- Shrinkage rate is less as compared to other type of

concrete.

- The preparation of green concrete is not much differ than ordinary concrete and the cost is relatively low.
- Uses of green concrete reduces the effect of pollution on environment and solve the problem of disposal of constructional wastes.

8. Disadvantages of Green Concrete

- The structure made by green concrete have less life than ordinary concrete.
- Characteristics like compressive strength are less as compared to conventional concrete.
- The flexural strength of the green concrete is less as compared to ordinary concrete.
- Permeability is relatively high.
- The split tensile strength of green concrete is less as compared to conventional concrete.
- By using stainless steel, the cost of reinforcement increases, in the eco-friendly concrete.
- The green concrete is not used in heavy structures like dams, bridges, because of its less life span.

9. Conclusion

- The byproduct of some industry is silica fume which may cause air pollution.
- To make concrete more sustainable the more silica addition is necessary in cement which reduces air pollution.
- To produce green concrete there is significant potential in waste material.
- The replacement of traditional constituents of concrete

with some by products and industrial wastes gives an opportunity to produce economical and environment friendly concrete.

- A detailed life cycle analysis of green concrete by considering various parameters is very much necessary in order to understand the resultant concrete properties.
- The better compressive strength, tensile strength, improved sulphate resistance, decreased water absorbing capacity and improved workability can be achieved by the partial replacement of ingredients by using waste materials and admixtures.
- The strength of cement gets increased when the appropriate amount of silica fume is added but this replacement of silica fume may decrease the strength of the concrete.
- By using the technologies, we prepare a concrete by using industrial waste which is more beneficial and economical than conventional concrete.

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