

“Green Concrete” – A Review Study

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Abstract: - 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.

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I. INTRODUCTION

Concrete is the most widely used construction material in the world (Aitcin, 2000; Mobasher, 2008). It contains four basic ingredients: water, cement, fine aggregate (sand) and coarse aggregate. The manufacturing of traditional concrete using Portland cement (PC) which releases a large amount of greenhouse gases such as CO₂ (Meyer, 2005; Bentz, 2010; Bondar et al., 2011). Also, the production of Portland cement is energy-intensive. The use of supplementary cementitious materials (SCMs), recycled aggregates and other industrial wastes could reduce the environmental impacts of concrete production (Lepech et al., 2008). In this study, aggregates from recycled waste streams or other non-conventional aggregate materials (e.g., lightweight aggregate) are defined as alternative aggregate (AA). The SCMs and AAs are called “green” raw materials in this paper. According to Mannan and Ganapathy (2004), using agricultural and industrial wastes as replacement materials in the concrete industry has dual advantages of cost reduction and a better way of waste disposal. They also pointed out that the material recovery from the conversion of these wastes into useful materials benefits both the environment and the conservation of natural resources.

The environmental problem arising from unscientific and indiscriminate disposal of municipal solid waste (MSW) is a real menace for the whole society. These wastes are increasing day by day due to increase in population, urbanization, and industrialization. The characterization of MSW shows that it contains about 55–65% of compostable material, 25–35% of dry/recyclable materials, and 15–20% of inert material. In India, the amount of MSW generated per capita is estimated to increase at a rate of 1–1.33% annually. The provision of land filling for MSW management is not a primary solution; the technology and science has to play the major role in the successful implementation of waste management. It needs paradigm shift in vision in managerial concept to focus more on waste minimization or complete recycling of waste rather than getting rid of land filling. As far as possible, the landfill step has to be omitted from the mind by giving more emphasis on 100% recycling of waste.

Green concrete is a revolutionary topic in the history of concrete industry. This was first invented in Denmark in the year 1998. Green concrete has nothing to do with colour. It is a concept of thinking about environment in making of concrete considering every aspect from raw materials, manufacture over mixture design to structural design, construction, and service life. GREEN concrete has nothing to do with color. It is a concept of using eco-friendly materials in concrete, to make the system more sustainable. Green concrete is very

easy to use and also cheap to produce as waste products are used as a partial substitute for cement ingredient. The size of construction industry all over the world is growing at faster rate. The huge construction growth boosts demand for construction materials. Aggregates are the main constituent of concrete. Due to continuously mining the availability of aggregates has emerged as problems in recent times. To overcome this problem, there is need to find replacement Solution to some extent. The solution is known as “Green Concrete”.

II. LITERATURE REVIEW

Ruoyu jin et.al, Concrete is the most largely consumed construction material worldwide. The production of raw materials used in concrete such as Portland cement requires a significant amount of energy input and causes various environmental problems (e.g., emission of greenhouse gases). The “green” concrete in this paper is defined as the concrete produced by utilizing alternative and/or recycled waste materials (such as fly ash and recycled concrete aggregates) to reduce energy consumption, environmental impact, and natural resource use. One of major issues associated with “green” concrete is how the alternative/waste cementitious and aggregate materials affect concrete properties compared with the conventional Portland cement concrete. Another important issue is whether all the benefits and barriers of producing “green” concrete have been adequately understood or addressed. In addition, it is unknown whether a consistent understanding of the current status of “green” concrete exists between academia and industry. This paper first discusses potential benefits of using alternative and/or waste materials in concrete production, followed by a review of previous studies on “green” concrete. The paper further investigates the current status of producing “green” concrete in the construction industry by surveying concrete suppliers/manufacturers in the U.S. The findings presented provide a deeper understanding on the production and implementation of “green” concrete.

C.Meyer et.al, this paper summarizes the various efforts underway to improve the environmental friendliness of concrete to make it suitable as a “Green Building” material. Foremost and most successful in this regard is the use suitable substitutes for Portland cement, especially those that are byproducts of industrial processes, like fly ash, ground granulated blast furnace slag, and silica fume. Also efforts to use suitable recycled materials as substitutes for concrete aggregate are gaining in importance, such as recycled concrete aggregate, post-consumer glass, tires, etc. The paper discusses some of the economic drivers which determine the degree of commercial success. Simply depositing of waste materials in concrete products is unlikely to succeed except in unusual situations. But by identifying and exploiting specific properties inherent in various waste materials or byproducts, it is possible to add value to such materials and increase their chances of success in a market-driven economy of supply and demand. Also, the emergence of the Green Building movement in North America is already changing the economic landscape and the factors that influence resource utilization.

Prof. Chetna M Vyas et.al, the use of Recycle product is increasing with innovation in present scenario. The utilization of waste product in the manufacturing of new product is a challenging job. The Natural Resource decreases in a short period and therefore the use of waste product is necessary. There are a number of old buildings and structures which are demolished today. The reuse of that demolished debris is a good solution to the problem of an excess of waste material. The studies on the use of recycled aggregates have been going on for few years. Aggregates play important role in strength characteristic of concrete. This paper focuses on the possibility of the use of recycled coarse aggregate concrete as a new structural material. For that purpose a literature survey for use of recycled aggregate concrete is studied. Recycled coarse aggregate (RCA) obtained from crushed concrete rubble and different demolished work. Instead of being stored, it can be reused in the building industry. Recycled aggregates are comprised of crushed, graded inorganic particles which are obtained from demolition debris. The aim of this research project is to determine the strength characteristic of recycled coarse aggregate concrete by using different percentage of recycled aggregates in M45 Grade. The results with 40% use of recycled coarse aggregates give workable, strong and green concrete.

Bambang Suhendro et.al, 8 to 10 percent of the world's total CO₂ emissions come from manufacturing cement. The global warming gas is released when limestone and clays are crushed and heated to high temperatures. Green concrete is defined as a concrete which uses waste material as at least one of its components, or its production process does not lead to environmental destruction, or it has high performance and life cycle sustainability. Various efforts have been conducted by researchers to arrive at some alternatives that are able to significantly reduce high energy consumed and environmental impacts during fabrication A Review on Outcome of Green Concrete (IJSTE/ Volume 3 / Issue 06 / 035) All rights reserved by www.ijste.org 197 process of cement, including implementing the concept of industrial ecology and green chemistry as well as nano engineering that study the behavior of the structure and organization of nano particles of cement in the mix for achieving higher performance. The cleaner technologies in concrete production, such as substituting relatively high percentage of cement by fly ash (up to 100%), the use of other natural pozzolans, development of concrete with recycling or waste materials, and developing nano concrete by integrating CNT's or self-sensing CNT's in the concrete mix for higher performance in terms of strength, stiffness, and durability, have been developed and are addressed in this paper. Several efforts that have been done so far in implementing the

concept of green concrete and material development of nano silica in Indonesia is discussed. Finally, problems in the realization of and potential barriers to green concrete as well as political scenarios that have been adopted by several countries through implementation of various priorities and deregulation in various fields are also discussed.

III. MATERIAL SELECTION

A. Efficiency of Resources:

It mainly includes properties like natural recycled content/renewable recycled content, efficient resource manufacturing process, refurbished or reusable and durability.

B. Energy Efficiency:

The energy required to make this concrete is known as energy efficiency. The materials which require the amount of energy during the construction period of the concrete are mostly preferred.

C. Conservation of Water:

Water is mainly conserved by using materials that help us and conserve water in landscape areas and even help to reduce the consumption of water in building materials.

Replacement materials:

Cement:

The reduction in the use of Portland cement can be achieved with partial replacement of cement by the various cementitious materials, such as:

- GGBS
- Fly ash
- Silica fume
- Recycled glass

Aggregates:

It can be produced by the use of recycled material few of these are as follows:

- Recycled concrete waste
- Quarry dust
- Solid waste
- Plastic Waste
- Recycled glass

IV. BENEFITS OF GREEN CONCRETE

Longer life

The strength is gained by the green concrete at a much faster rate and it has a very low shrinkage rate than other types of concretes. If a structure is built by using this type of concrete, then it has a better chance of surviving the fire. In addition to this, it has a greater resistance to corrosion.

Use of industrial waste

Around 25% to 100% fly ash is used to produce the green concrete instead of a 100% mixture of Portland cement. Fly ash is collected from the chimneys, which uses the coal as the power source. In industries, there is an abundance of fly ash available. In general, there are lots of lands used for disposing of the fly ash and the land can be saved by using fly ash for creating the green concrete.

Reduced amount of Carbon Dioxide Emissions

The major ingredients of the ordinary cement are clay, sand and pulverized limestone and they are heated to a very high temperature. On average, this process produces carbon dioxide emissions between 5 and 8% across the world, whereas the production of green concrete releases nearly 80% lesser carbon dioxide emissions. Choosing green concrete for construction processes will help a lot to reduce carbon dioxide emissions.

Reduced Energy Consumption

One will use less energy if you are using green concrete having less Portland cement and more fly ash. A building constructed by using this type of concrete offers better resistance to the changes in temperature. Generally, the architect designs a building using a green concrete to use energy for heating and cooling in an efficient manner.

Advantages of Green Concrete:

- Much change is not required for the preparation of green concrete compared to conventional concrete.
- Reduces environmental pollution.
- Have good thermal and acid resistance.
- Compressive and split tensile strength is better with some materials compared to conventional concrete.
- Reduces the consumption of cement overall.
- Green concrete is economical compared to conventional concrete.
- Green concrete having better workability than conventional concrete.

V. LIMITATIONS OF GREEN CONCRETE

- By using stainless steel, cost of reinforcement increases.
- Structures constructed with green concrete have comparatively less life than structures with conventional concrete.
- Split tension of green concrete is less than that of conventional concrete

Disadvantage of Green Concrete:

- Compressive strength and other characteristics are less compared to conventional concrete.
- Water absorption is high during curing.
- Shrinkage and creep are high compared to conventional concrete.
- Flexural strength is less in green concrete

VI. 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.

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