

- Green Concrete

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 environment into concrete considering every aspect from raw materials manufacture over mixture design to structural design, construction, and service life. Green concrete is very often also cheap to produce, because, for example, waste products are used as a partial substitute for cement, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. Green concrete is a type of concrete which resembles the conventional concrete but the production or usage of such concrete requires minimum amount of energy and causes least harm to the environment. The CO<sub>2</sub> emission related to concrete production, inclusive of cement production, is between 0.1 and 0.2 t per tonne of produced concrete.

However, since the total amount of concrete produced is so vast the absolute figures for the environmental impact are quite significant, due to the large amounts of cement and concrete produced. Since concrete is the second most consumed entity after water it accounts for around 5% of the world's total CO<sub>2</sub> emission (Ernst Worrell, 2001). The solution to this environmental problem is not to substitute concrete for other materials but to reduce the environmental impact of concrete and cement. Pravin Kumar et al, 2003, used quarry rock dust along with fly ash and micro silica and reported satisfactory properties.

The potential environmental benefit to society of being able to build with green concrete is huge. It is realistic to assume that technology can be developed, which can halve the CO<sub>2</sub> emission related to concrete production. With the large consumption of concrete this will potentially reduce the world's total CO<sub>2</sub> emission by 1.5-2%. Concrete can also be the solution to environmental problems other than those related to CO<sub>2</sub> emission. It may be possible to use residual products from other industries in the concrete production while still maintaining a high concrete quality. During the last few decades society has become aware of the deposit problems connected with residual products, and demands, restrictions and taxes have been imposed.

And as it is known that several residual products have properties suited for concrete production, there is a large potential in investigating the possible use of these for concrete production. Well-known residual products such as silica fume and fly ash may be mentioned. The concrete industry realised at an early stage that it is a good idea to be in front with regard to documenting the actual environmental aspects and working on improving the environment, rather than being forced to deal with environmental aspects due to demands from authorities, customers and economic effects such as imposed taxes. Furthermore, some companies in concrete industry have recognised that reductions in production costs often go hand in hand with reductions in

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environmental impacts. Thus, environmental aspects are not only interesting from an ideological point of view, but also from an economic aspect.

### Environmental Goals

Green Concrete is expected to fulfil the following environmental obligations:

Reduction of CO<sub>2</sub> emissions by 21 %. This is in accordance with the Kyoto Protocol of 1997.●

Increase the use of inorganic residual products from industries other than the concrete industry by approx. 20%.●

Reduce the use of fossil fuels by increasing the use of waste derived fuels in the cement industry.●

The recycling capacity of the green concrete must not be less compared to existing concrete types.●

The production and the use of green concrete must not deteriorate the working environment.●

The structures do not impose much harm to the environment during their service life.●

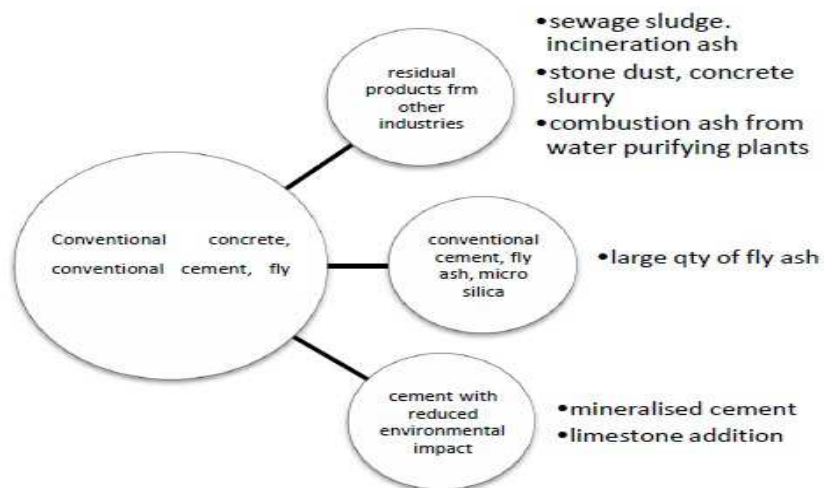


Fig. 1 A chart depicting the methods to develop green concrete

### Advantages of Green Concrete

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concrete has manifold advantages over the conventional concrete. Since it uses the recycled aggregates and materials, it reduces the extra load in landfills and mitigates the wastage of aggregates. Thus, the net CO<sub>2</sub> emissions are reduced. The reuse of materials also contributes intensively to economy. Since the waste materials like aggregates from a nearby area and fly ash from a nearby power plant are not much expensive and also transport costs are minimal. Green concrete can be considered elemental to sustainable development since it is eco-friendly itself. Green concrete is being widely used in green building practices.

It also helps the green buildings achieve LEED and Golden Globe certifications. Use of fly ash in the concrete also increases its workability and many other properties like durability to an appreciable extent. One of the practices to manufacture green concrete involves reduction of amount cement in the mix, this practice helps in reducing the consumption of cement overall. The use waste materials also solve the problem of disposing the excessive amount industrial wastes.

There are several other advantages related to green concrete and can be summarized as below:

- a) Reduced CO<sub>2</sub> emissions.
- b) Low production costs as wastes directly substitute the cement.
- c) Saves energy, emissions and waste water.
- d) Helps in recycling industry wastes.
- e) Reduces the consumption of cement overall.
- f) Better workability.
- g) Sustainable development.
- h) Greater strength and durability than normal concrete.
- i) Compressive strength and Flexural behaviour is fairly equal to that of the conventional concrete.
- j) Green concrete might solve some of the societies' problems with the use of inorganic, residual products which should otherwise be deposited.