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Experimental Study on Green Concrete

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Abstract: conventional concrete is responsible for amount of carbon-dioxide emission to some extent. So to reduce the emission, various types of concrete are developed using waste products from industries and agricultural use like blast furnace slag, silica fume, fly ash which requires low amount of energy and also cause least harm to the environment. Green concrete is a new technology developed now days to reduce the effect on environment by production of cement. Cement contains high amount of carbon-di-oxide which harms the environment drastically, so by replacing the cement by various materials which causes harm to the environment we not only reduce the problem of disposal of these materials but we reduce the emission of carbon-di-oxide from cement and as a result of which we reduces the negative effect on environment.
Keywords - green concrete, silica fume, demolished brick aggregate, co_2 emission, eco-friendly concrete.

I. INTRODUCTION

Color has nothing to do with green concrete. It is a concept of thinking and environment into an every aspect of the raw materials manufacture over construction, mixture design to structural design, and durability. Green concrete is very often considered to be cheap to produce due to the use of recycled material whereby avoiding the charges for the disposal of waste, less energy consumption and greater durability.

While a normal construction practices are guided by short term economic considerations, sustainable construction is focused on best practices which emphasize on long term affordability, durability and effectiveness. At each stage of the life cycle of the construction, it increases ease and quality of life, while minimizing the negative environmental impacts and increasing economic sustainability of the construction. Any infrastructure designed and constructed in a sustainable way minimizes the use of resources through the whole life cycle of the construction process in which the green concrete play a vital role in achieving the sustainable construction. Having so much of advantageous has led to popularity in construction world and one of the emerging technology in sustainable construction. Green concrete is miracle of present and tool for future when the natural resources are on the verge of extinction.

Due to growing interest in sustainable development, engineers and architects are motivated more than ever before to choose materials that are more sustainable. Selection of material for concrete is more sustainable and minimizes environmental impact. Cement production accounts for more than 6% of all CO_2 emission which is a major factor in the world's global warming (Greenhouse gas). India is the third largest cement producer in the World and one of the largest consumers of cement per capita in the world. Rough figures are that India consumes about 1.2 Ton/year/capita, while as World average is 0.6 Ton/year/capita. CO_2 emissions from 1 ton of concrete produced vary between 0.05 to 0.13 tons. 95% of all CO_2 emissions from a cubic meter of concrete are from cement manufacturing.

Cement is the one of the major component of the concrete. The production of one ton of cement releases one ton of a CO_2 into the atmosphere. CO_2 is known to be greenhouse gas that contributes to the global warming. The reduction in CO_2 emission from a concrete can be achieved with a partial replacement of cement by the various supplementary cementitious materials. The use of these cementitious materials has resulted in an improvement of the properties of concrete.

So to reduce this environmental impact green concrete plays a vital role. By using recycled materials or waste materials which are harmful to the environment as a replacement of cement such as fly ash, silica flume, etc. we can reduce the CO_2 emission from concrete as well as it reduces the environmental impact on earth. As a result of which green concrete is one of the major tool in the future when the natural resources are on verge of extinction.

Fig no.1 : Micro Silica

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II. OBJECTIVES

A. To study the effect of silica fume on the enviornment.
B. To study the effectiveness of concrete by partial replacement of cement by silica fume.
C. To determine the strength of new mix design concrete of grade M40.
D. To determine the various test results like compression test, flexural test & split tensile test.
E. To find the optimum percentage of silica fume in cement so that we can achieve maximum strength by increasing percentage as 5%,10%,15%,20%.

III. LITERATURE REVIEW

In 2016, Anita Bhatia, et al[1] publishes a paper on green concrete in which they concluded that green concrete is very low energy and resource consumption, no environmental pollution and sustainable development. One can conclude that overcoming the above demerits would help to use the green cement concrete with a potentially new environmental friendly world. With the waste material as an alternative we can help to reduce the environmental problems and protect the naturally available materials for the future generation. (1)

In 2016, Praveer Singh, et al[2] studied about the silica fume and comes to the conclusion that cement is becoming a scarce resource all over the world because of increase in demand day by day. The use of silica fume as a pozzolana material has increased in recent years because when mixed in certain proportions it enhances the properties of both fresh and hard concrete. Addition of silica fume in proper proportion improves durability attack by acidic waters and improving concrete conditions. (2)

In 2016, Tae Hyoung Kim, et al[3] does study about the CO_2 emission from concrete and concluded that concrete, a common construction material, is known to emit large amount of environmentally hazardous waste during the processes related to its production, construction, maintenance, and demolition. The CO_2 emitted in a concrete production affect the acidification and global warming. (3)

In 2015, Kasi Rekha, et al[4] studied about the brick wastes and concluded that the recycled brick aggrigate concrete is made used for the production of low grade recycled aggregate suitable for concrete production. The results showed that recycled brick aggreagte concrete performed better than granite aggregate concrete at high temperature. The fire resistance of recycled brick aggregate concrete is better than the fire resistance of granite aggregate concrete. (4)

In 2015, Dhiraj Kumar Tiwari, et al[5] studies about the green concrete and concluded that green concrete capable for sustainable development is characterized by application of industrial wastes to reduce consumption of natural resources and energy and pollution of environment. Application of green concrete is an effective way to reduce environment pollution and improve durability of a concrete under severe conditions. Green concrete has the good thermal & fire resistance. (5)

In 2015, Xian LI, et al[6] conducted an experiments on concrete having fine aggregate replacement by demolished brick waste and they comes to the conclusion that recycled waste brick aggregate has obvious different properties from recycled concrete aggregate and is hardly accepted because of its lower strength the effect of recycled waste brick fine aggregate on compressive strength and flexural strength of mortar was studied. A good bond exists between recycled brick aggregate & the cement paste. The fire resistance of recycled brick aggregate concrete is better. (6)

In 2015, Kakamare M.S., et al[7] studied about the Sustainable Construction Materials & Technology in which they concluded that green concrete is a type of concrete which resembles the conventional concrete but the production or uses of such concrete requires minimum amount of energy and causes least harm to environment. Green concrete is a very low energy and resource consumption, no environmental pollution, sustainable development. Green Concrete has good thermal and fire resistance, sound insulation than the traditional granite rock. (7)

In 2015, Mohammed Tarek Uddin1, et al[8] studied about the demolished brick waste replacement as an aggregate and they concluded that investigations were carried out to explore the possibility of recycling of demolished brick aggregate concrete as coarse and fine aggregate. The compressive strength of mortar portion of concrete is higher than the compressive strength of recycled aggregate concrete; it indicates that failure of concrete specimen is initiated in recycled coarse aggregate. (8)

In 2014, Dewanshu Ahlawat, et al [9] replaces the coarse aggregate by coconut shell & concluded that concluded that the rising cost of construction material is a matter of concern. The reason for increase in cost is high demand of concrete and scarcity of raw material. Hence the concrete technologists must search for some economical alternative to the course aggregate. Increase in percentage replacement by coconut shell reduces compressive strength of concrete. (9)

In 2014, Abhijeet Baikerikar[10] reviews the green concrete concept and he concluded that construction industry is growing rapidly

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and new technologies have evolved very fast to cater different difficulties in the construction industry. Billions of tons of naturally occurring materials are mined for the production of concrete which will leave a substantial mark on the environment. This review paper gives a brief idea about the advantages and disadvantages about the green concrete. Replacement of traditional ingredients by waste material and by products gives economical & environment friendly concrete. (10)

In 2014, Chirag Garg, et al[11] publishes the review paper on green concrete & they come up with the conclusion that the concrete is made with concrete wastes which are eco-friendly so called as green concrete. The paper covers the aspect on how to choose a material for green concrete. It has been observed that 0.9 tons of CO_2 is produced per ton of cement production. Also the composition of cement is a 10% by weight in eco-friendly construction technique. Thus, by the use of green concrete it is possible to reduce CO_2 emission in the atmosphere towards eco-friendly construction technique. A trend is increasing of incentives for the greater use of manufactured and recycled aggregates in construction. (11)

In 2014, Umesh Sharma, et al[12] studied about the silica fume & concluded that concrete is the most important engineering material in a construction industry because of its inherent strength properties. Micro silica primarily of very fine smooth spherical silicon oxide particles with an extremely high surface area. Micro silica particle are 100 times smaller than as that of cement particle. Silica fume is usually categorized as a supplementary cementitious material. These material exhibit pozzolanic properties, cementitious properties and a combination of both properties due to this properties it can affect the concrete behaviour in many ways. Silica fume is a material which may be a reason of Air Pollution. This is a by-product of some Industries. Use of micro-silica with concrete decreases the air pollution. Silica fume also decrease the voids in concrete. (12)

In 2012, N. K. Amudhavalli et al[13] concluded that Portland cement is the most important ingradient of concrete and is a varsetile and relatively high cost material. Lasrge scale production of cement is causing enviornmental problems on one hand and depletion of natural resourses on other hand. This threat to ecology has led to researchers to use industrial by products as supplementry cementatious material in making concrete. This paper represents the detail experimental study on compressive strength, flextural strength and split tensile strength. Consistency of cement depends upon its fineness. Silica fume is having greater fineness than cement and greater surface area so the consistency increases greatly, when silica fume percentage increases. (13)

In 2012, Verma Ajay, et al[14] concluded in there paper that concrete is the most important engineering material and the addition of some other materials may change the properties of concrete. With increase in a trend towards the wider use of concrete for high rise buildings there is a growing demand of concrete with higher compressive strength. There are two types of materials crystalline and noncrystalline. Micro silica or silica fume is very fine non crystalline material. Silica fume is produced in electric arc furnace as a by-product of the production of elemental silicones or alloys containing the silicon. Silica fume was initially viewed as cement replacement material and in some area it is usually used as replace by much smaller quantity of silica fume may be used as pozzolanic admixtures. Silica fume increases the strength of concrete more 25%. Silica fume is much cheaper than cement therefore it very important from economical point of view.(14)

IV. METHODOLOGY

A. To find out number of literature on green concrete.
B. To study about the ingredients of green concrete.
C. Collection of various ingredients required for project from different outsources.
D. To design a concrete mix for M40 grade as per the Indian Standard Recommended method**.**
E. To cast cubes, beams & cylinders by using a various ingredients as per mix design.
F. To test the casted cubes, beams & cylinders for strength after 7, 14, 28 days of curing respectively by performing various test like compressive test, flexural test & split tensile test.
G. To calculate the economy for green concrete.
H. To compare between conventional concrete and green concrete based on various parameters.

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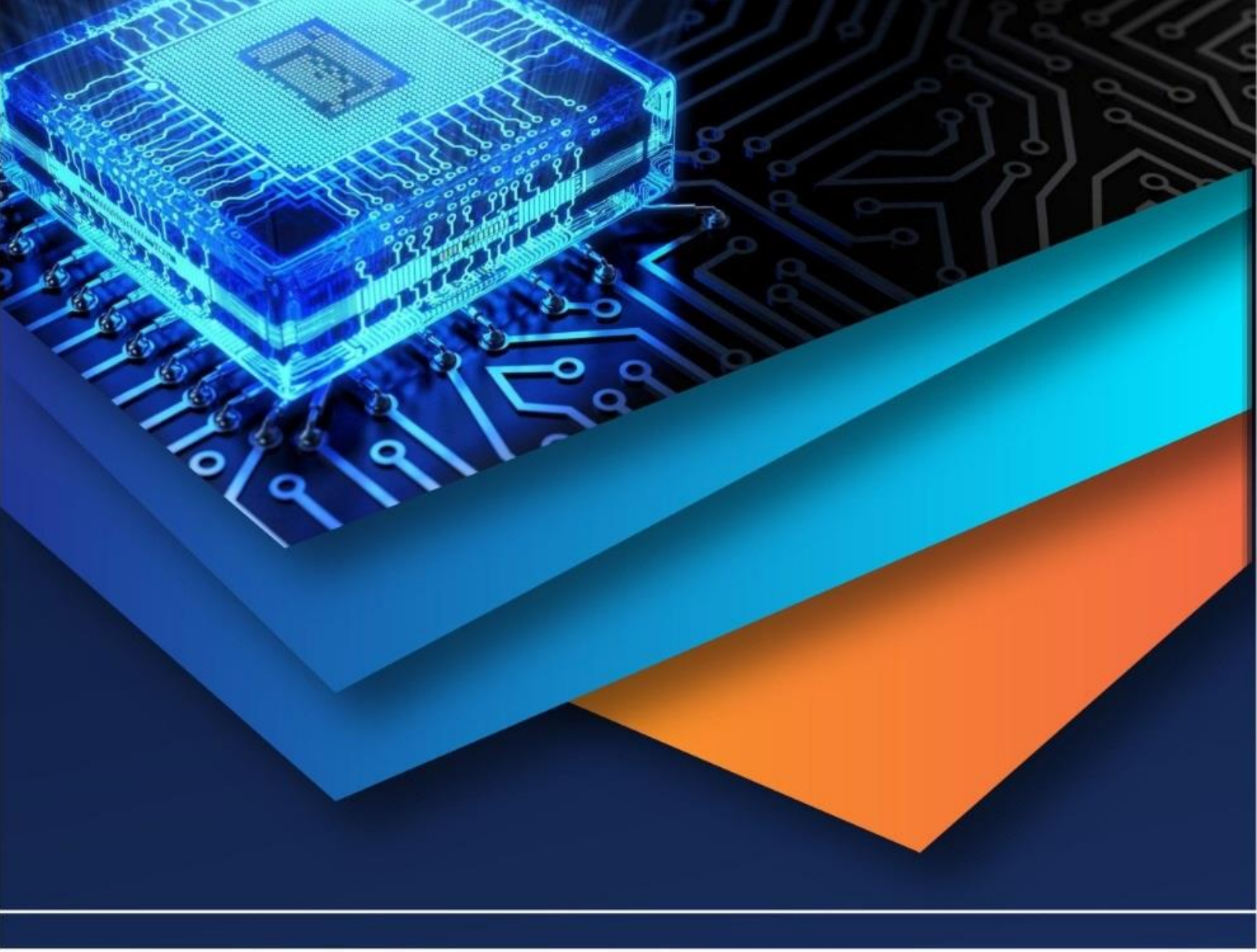

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