



# EXPERIMENTAL INVESTIGATION ON COMPRESSIVE STRENGTH OF CONCRETE DEVELOPED BY BRICK KILN DUST

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## ABSTRACT

*Now a days the construction work increases day by day in large scale all over the globe. As the construction work increase the requirement of cement is also increase in the huge amount as well. India is developing nation country, the demand for cement consumption and production increase day by day. India is the 2<sup>nd</sup> largest country in globe which produced the cement and consumes the cement. Due to use of cement in a huge amount it also affects our surrounding environment so green concrete is the best alternate of conventional concrete to reduce the CO<sub>2</sub>, it will also have the impact on compressive strength of concrete and it is very cost effective also reduce the waste by utilizing the waste into the concrete. It is efficient for continuous development characterizing by utilization of industrial waste, fly ash brick kiln dust, etc. The utilization of agriculture waste like Rice husk ash, bagasse dust in concrete as various proportion of substitution of cement is innovative ideas to reduce pollution.*

**Key words;** Cement, Concrete, Brick Kiln Dust, Green Concrete.

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## 1. INTRODUCTION

Cement is a second largest thing used after water all across the world. Concrete is defined as when cement (binder) fine aggregate, gravel and water are mix with each other in fix proportion is known as concrete. Concrete is used in dams, highways, dams, bridge etc. In concrete, the all the material has their own function and requirements. In which cement is helps to bind the material with each other. It acts as a binder. It becomes set and hard when it reacts with water and provides strength on setting and hardening. Fine aggregates are those aggregate which passes through the sieve of 4.75 mm. it plays a very important role in concrete. Sand is very

common fine aggregate is used in concrete. Natural and artificial sand is used to prepared concrete. Sand helps to give bulk, remove void and cracking, increase strength and increase the workability of concrete. Coarse aggregate is uncrushed gravel or stone which is obtained from natural disintegration of stone is called coarse aggregate. Or which is holding on 4.75mm sieve. It helps to increase the crushing strength of concrete; it carries the large volume of concrete. Water shows a very essential act in concrete both for construction or service life of concrete. It helps to make concrete workable, increase the strength and durability of concrete. Water is used in a controlled manner. Green concrete word is related to concrete which is an innovative idea in the history of concrete. It is very effective to reduce the pollution which is generating by the consumption of cement. Green concrete is firstly used in Denmark in 1998. Dr.W.G who invented the green concrete. Green concrete is not green color it is a concrete which is manufactured industrial and agricultural waste like rice husk, sawdust, bagasse ash, slag, GGBS, fly ash. Green concrete is manufactured by adding or replacing the cement up to some percentage like 5%, 10%, 15%, and so on with waste material which shows the pozzolanic properties with cement in concrete. Green concrete has a less harmful impact on the environment. Cement is a major part of concrete which is responsible for the discharge of harmful gas in the environment. In green concrete, the cement is replaced which the waste material which is obtained from industrial and agricultural waste so emission of CO<sub>2</sub> up to some extent. Main materials which can be replaced cement are;

Fly ash, rice husk ash sawdust ash, recycled glass aggregate, brick kiln dust, cement kiln dust etc. Green concrete helps to cut back in shrinkage and creep, it can reuse material and the heat of hydration is lower in conventional concrete. It can be used in the construction of bridge, building and road construction. Green concrete resolves the problem of dumping waste material in open environment which emits harmful and hazardous gases. It also helps to manufactured low-cost concrete by adding replacement of cement in concrete.

### Brick Kiln Dust

Brick is earlier construction material. Brick kiln dust is obtained from a brick kiln. In India brick industries are isolated into 3 different regions:-

Northern Region, Gangetic Plains, and South Regions

Northern regions: -- The production of bricks in northern regions is quite low and it is limited in plains of northern regions like Himachal, Jammu Kashmir, and Dehradun.

Gangetic Plains: - Gangetic Plains contribute about 60 to 65% of total production of brick. Punjab, Bihar, UP, Haryana and West Bengal are the main states in that region for the production of brick.

South Regions: - south regions contribute 30% of brick production. The production of bricks ranges from 0.1 to 2.7 million bricks per year. Gujarat, MP, Tamil Nadu, Orissa is the main brick production state in that region.

S.NO	STATES	PRODUCTION OF BRICKS (number of brick/year)	NUMBER OF KILN
1	Himachal Pradesh	2-2.2 million	2000-2800
2	Punjab	4-7 million	3000- 4200
3	Haryana	4-9 million	2500-3000
4	Bihar	2-5 million	Approx 4000

The large numbers of the brick kiln are planned or constructed in the country and huge quantity of brick kiln dust is generated as the waste product and this waste product is dumped into open environment which is harmful for surrounding. The prime ingredients of brick kiln dust are clay and sand. Brick kiln dust (BKD) is obtained from the manufacturing process of

bricks. Brick dust is in the powder form which is left in the kiln. Brick dust is composing of clay that has the sufficient amount of silica and alumina which is when combined with lime it shows some pozzolanic properties. If Brick dust is used as a replacement for a percentage of cement then it will not only reduce the problem of disposing of this waste, it will also reduce the environmental impact which is caused by the CO<sub>2</sub> emission from the manufacturing of the cement. Brick kiln dust is also utilized as fine aggregate in the concrete mix.



Brick Kiln Dust

## 2. LITERATURE REVIEW

**(Hemraj R. Kumavat, 2013)** Study the utilization of BKD (Brick Kiln Dust) as a substitution of cement or fine aggregate in mortar or concrete as BKD act as a pozzolanic material. It gives a major may contribute to low the negative side effect of the manufacture, removing and the destruction of brick kiln dust on the surrounding He finds that the affluent mix give less rate of bulk density and high rate of the compressive strength (CS) for fine aggregate (sand) substitution with brick kiln dust up to 40%

**(B.Rogers, 2011)** Study the best methodology to find out if brick kiln dust will generate a pozzolana action when it is co-operating with the lime. This aspect points out to as pozzolanic. The study needs a review of the aspects of pozzolana materials, nature of pozzolana action, and a revision of current techniques for finding out pozzolanic. A trial program execute at the Architectural Conservation Laboratory at the University of Pennsylvania was describe and carried to determine the techniques for evaluating pozzolanicity of brick kiln dust to analyzed their utility..

**(Sharda Sharma, 2014)**study on concrete block pavements that have the presentation of the solid section with interlinking aspect with one another for placing on the road or pedestrian. As per need and utilization, there is different design, patterns, shape, and sizes of CBPs are present nowadays. In this study, they examine the investigation for construction of blocks with various substitution of the cement with BKD in concrete mix 0 %, 5 %, 10 %, 15 %, 20 %, 25 % and 30 % with the addition of super plasticizer admixture is max 2 % of super plasticizer is used by weight of cement. Her findings determine the compressive strength (CS) and water absorption of paver block at 7 and 28 days

**(Hasanpour, 2013)** study the benefits of utilization brick kiln powder of Gachsaran Company in concrete. Cement is substitute by brick kiln dust in various ratios until 40% by the weight of cement. a pozzolanic aspect of brick kiln dust and (CS)compressive strength of concrete were determined. This study evaluates that brick kiln dust demonstrates pozzolanic aspects. The study also determines that the concrete with various cement substitute by brick kiln dust has nominal strength fall. The results of the study verify the effective utilization of brick kiln dust material to generate pozzolana concrete.

**Ms. Monica C. Dhoka (2013)** experimental investigation on green concrete and discussed the aspect of concrete and strength by the utilization of waste. She discussed green concrete that how we can decrease the pollution in the surrounding by using a suitable amount of materials like cement and can improvise the strength of concrete under worst condition.

**Bambang Suhendro (2014)** investigate that 8 to 10% of the globe's total carbon discharge occurs by the production of cement and co<sub>2</sub> is discharged by mash limestone or soil. He evaluates the word green concrete that is the use of waste by substituting the cement. He describes surrounding pollution and its side effects.

**Garg Chirag & Jain Aakash (2014)** study on green concrete to reduce the greenhouse emission and reuse the waste material. He finds that green concrete is a replacement of cement whereas it utilizes the waste material and provides strength and durability of conventional concrete by using standard for green concrete construction.

**Patel Ankit Nileshchandra & Prof. Jayeshkumar Pitroda (2013)** gives experimental investigation on green concrete and evaluate the profit of utilizing the stone dust in concrete manufacturing as partial substitution of cement and sand for decreasing the wastage and emission of gasses problems. He replaces cement by the stone dust in ranges of 0%, 10%, 20%, 30%, 40% and 50% by weight for M-25 Grade concrete. He also evaluated mechanical properties of the specimen on compressive strength test for 28 days.

### 3. MATERIAL USED

#### Cement, Sand, C.A, and Water

Concrete is prepared by mixing of sand, cement, water, and coarse aggregate in fix proportion. 43 grade of OPC is used for the research work which is free from impurities, lumps and fulfills all IS specification of cement. Sand, utilized as the aggregate in the concrete mix that is collected from the natural and artificial resource. Fine aggregate which passes throw the 4.75mm sieve used in this work. Coarse aggregate size of 16 to 20mm and rounded in shape is used in the work. Water is used in work is free from impurities and ph value of water is 7.

#### Brick Kiln Dust

Brick kin dust is collect from brick kiln place near Kangra in Himachal Pradesh. It is used to replace cement in concrete up to some extent; the brick kiln dust which is collected from local kiln has been passed through 90-micron sieve before adding or replacing it with cement. The brick kiln dust should be in a fine powder of 90-micron size.

The physical aspects of brick dust are as follow:



**Physical aspect of Brick kiln Dust**

SNO.	LAB OBSERVATION	RESULTS
1	FINENESS MODULUS (%)	3.73
2	SPECIFIC GRAVITY (S.F)	2.35
3	BULK DENSITY(kg/m)	1837
4	OPTIMUMMOISTURE CONTENT (OMC %)	17
5	MAX DRY DENSITY (Mg/m <sup>3</sup> )	1.5

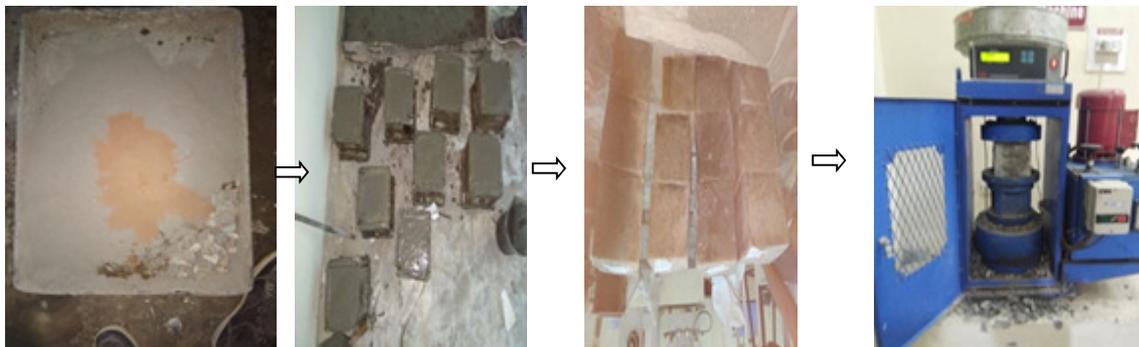
**4. METHODOLOGY**

**Experiment Schedule**

Main objective on which the research is based to find the compressive Strength (CS) of concrete manufactured by substitution of the BKD ( Brick kiln dust) also determine the important parameter such as compressive strength of concrete by addition of BKD with various %age of replacement with the cement. M40 design mix of concrete is prepared by applying IS specification. The replacement of brick kiln dust was varying from 5%, 10%, 15%, 20%, 25%, and 30%. Total 36 cubes were cast and 6 cubes were cast for conventional concrete.

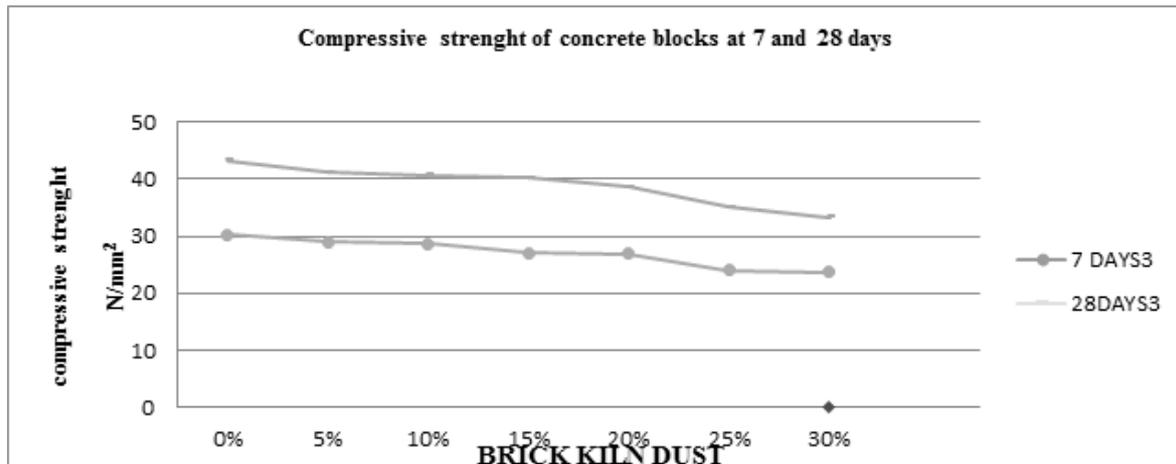
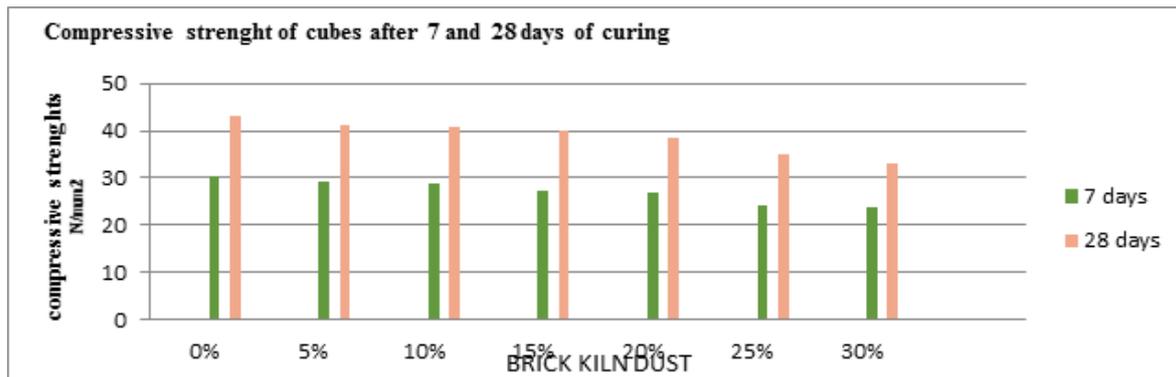
**CASTING OF CUBES**

To analyze the outcome of substitution of cement for different %age of the brick kiln dust total 36 number of cubes and 6 cubes of conventional cubes were cast of size 150mm x150mm x 150mm to analyze the crushing strength of the concrete considering for 7 days and 28 days of the curing. Three cubes were cast for each mix for 7 and 28 days of the curing respectively. The workability of the concrete is analyzed by slump cone test. The mixing of concrete ingredients was mix uniformly until the mixture become homogenous. Then concrete is filled in the cubes and then cubes are compacted on a vibrating machine.



**5. RESULT AND DISCUSSION**

S.NO	DAYS	COMPRESSIVE STRENGTH OF CUBES AFTER 7 AND 28 DAYS OF CURING						
		CC	5%	10%	15%	20%	25%	30%
1	7 DAYS	30.21	29.01	28.63	27.09	26.81	24.05	23.65
2	28 DAYS	43.18	41.15	40.67	40.13	38.57	35.10	33.25



After the curing of 7 days and 28 days, the compressive strength of particular concrete blocks or cubes is displayed in figure for various partial substitution of BKD (brick kiln dust). In graph, it is clearly shown that if percentage of BKD (brick kiln dust) is increased in the strength of cubes are gradually decreased. The strength of cubes is high at 5% of replacement as the % age increase to 10% to 15% the strength of cube is slightly decreasing but it achieves the target mean strength of concrete for M40 concrete and it can be used for construction work. But as the % age of BKD (brick kiln dust) is increased to 20% and above it starts decreasing gradually. So it is concluded from above result that maximum 15% replacement of brick kiln dust is reliable to use in construction work.

## 6. CONCLUSION

The following conclusion is concluded from the research:-

- Compressive strength (CS) of the concrete by using brick kiln dust shows good results up to 15% as %age of substitution is increased the compressive strength (CS) of the concrete is reduced. If cement is replaced with brick kiln dust the price of the project is reduced.
- Brick kiln dust show the pozzolanic properties as the cement it can replace cement up to 15% and give equal strength
- Concrete which is produced by the replacement of brick kiln dust is heavy concrete which is used in the foundation and for the construction of dam.
- Brick kiln dust concrete is created with a satisfactory slump and the setting time the concrete is same the conventional concrete with the equal w/c ratio.
- Brick kiln dust carries red color which makes concrete more aesthetically pleasing.

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