A STUDY ON CONCRETE WITH PARTIAL REPLACEMENT OF FLY ASH (FAH) AS CEMENT AND CEMENT KILN WASTE (CKW) AS FINE AGGREGATE

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ABSTRACT

Cement Kiln Waste (CKW) is a fine-grained, solid, highly alkaline material removed from the cement kiln exhaust gas by scrubbers (filtration bag house and/or electrostatic precipitators).More than 88 million tons of fly ash is generated in India each year. Most of the fly ash is of Class F type. In this study two waste materials was used in concrete matrices. Namely; Fly ash and Cement kiln waste. In this study the use of cement kiln waste and fly ash will reduce the quantity of cement and river sand in concrete this will preserve the natural resource and produce ECO friendly concrete. Concrete specimens are made in three different ratio fine aggregate is replaced by CKW as 10%, 20%, 30% and cement is replaced by FA as 30% for three mix test results indicated that the use of 30% of Class F fly ash as a partial replacement of cement and 20% of Cement Kiln Waste as a partial replacement of river sand in concrete increased its 28-daycompressive and splitting tensile of the concrete.

INTRODUCTION

Concrete plays a major role in the design and construction of infrastructures. Two third of the volume of concrete is constituted by coarse and fine aggregates. The scarcity of the building material is increased every day. To meet this demand of building materials in future, it is necessary to find the suitable alternatives for preparing concrete.

Therefore, the available natural aggregates and waste materials from industry and agriculture are becoming increasingly important. Fly ash and cement kiln waste are the waste material produced during the process of manufacturing coal and cement. By using this two materials in concrete will reduce the usage of cement and river sand.

Aggregate naturally obtain from the rocks, gravels etc. Aggregate are classified into two categories fine aggregate and coarse aggregate. Fine aggregate most of which passes through a 4.75mm IS sieve and only that much coarser material as is permitted by the specification coarse aggregate are normally crushed lime stones. In our project we partially replacing fine aggregate by fly ash in concrete mix. This mix gives strength slightly more than the normal concrete.

MATERIALS USED

A. Cement:

Ordinary Portland cement of 53 Grade was used for casting all the Specimens. To produce a high strength concrete, the usage of high strength cements is necessary. The selection of brand and type of cement is the most important to produce a good quality concrete. It is also important to ensure compatibility of the chemical and mineral admixtures with cement. Ordinary Portland cement, 53 Grade conforming to IS: 12269 – 1987.

B. Cement Kiln Waste:

Concrete oven squander is the fine grained, strong, very soluble waste expelled from bond furnace fumes gas via air contamination control gadget since a great part of the CKW is really unreacted raw materials, large amounts of it can and are recycled back into the production process. Some CKW is reused specifically, while some requires treatment preceding reuse CKW not come back to the generation procedure is regularly arranged in arrive based transfer units (i.e., landfills, squander heaps are surface impoundments).

C. Coarse Aggregate:

The aggregates which are retained on the 4.75mm in IS Sieve, it's known as the coarse aggregate. The properties of coarse aggregates are decided the strength of the concrete. Therefore the aggregate should free from the minerals and chemical impurities. Crushed granite aggregate with specific gravity of 2.65 and passing through 20 mm sieve and retained on 12 mm will be used for casting all specimens.

D. Fly Ash:

Fly ash is also known as fuel ash, fly ash usually refers to ash produced during combustion of coal. Fly fiery remains is for the most part caught by electrostatic precipitators or other molecule filtration hardware's previously the fuel gases come to the fireplaces of coal fired control plants.




A) CEMENT B) CEMENT KILN WASTE C) COARSE AGGREGATE D) FLY ASH

TEST ON FINE AGGREGATE

A. FINENESS MODULUS OF FINE AGGREGATE:

1Kg of Fine Aggregate is taken and the IS sieves are arranged in the order as 4.75mm, 2.36 mm, 1.40 mm, 600µ, 425µ , 300µ , 125µ , 75µ. And it is shake by using mechanical sieve shaker. From the retained fine aggregate in sieve fineness modulus is calculated.

B. SPECIFIC GRAVITY OF FINE AGGREGATE

Specific gravity of sand is the ratio of its weight in air to the weight of an equal volume of water at temperature of 4^{o}c.

Specific gravity of sand is an important factor which is used in computing other properties of sand like degree of saturation, void ratio and its unit weight. Specific gravity of sand is calculated by using pycnometer apparatus.

PROPERTIES OF FINE AGGREGATE

Sl. No.	Properties	Values
1	Specific Gravity	2.65
2	Fineness Modulus	4.59

TEST ON COARSE AGGREGATE

A. SPECIFIC GRAVITY OF COARSE AGGREGATES

The specific gravity is required for the calculation of the yield of concrete or the quantity of aggregate required for a given volume of concrete. The specific gravity of an aggregate gives valuable information on its quality and properties. The higher the specific gravity of an aggregate, the harder and stronger it will be.

B. FINENESS MODULUS OF COARSE AGGREGATE

Fineness modulus is characterized as the empherical volume got by including the total level of the material held in every one of the strainers and separating the aggregate in this way acquired by 100."The sample should be kept at a room temperature not exceeding 110^{o}c.

TEST ON CONCRETE

Testing of hardened concrete plays as important role in controlling and confirming the quality of cement concrete works.

TESTS ON HARDENED CONCRETE

A. COMPRESSION TEST

It is the most common test conducted on hardened concrete and an easy test to perform. The majority of the attractive trademark properties of cement are subjectively identified with its compressive quality. The tests were completed on 150x150x150mm size block, according to Seems to be: IS 516-1959.".

A) Compression Testing Machine

B) Split Tensile Testing Machine

B. SPLIT TENSILE TEST

It is a method of determining the tensile strength of concrete using a cylinder which splits the specimen across the vertical diameter. It is expressed as the minimum tensile stress (force per unit area) needed to split the material apart. It is also known as Brazilian test and dimetral compression test. The test was carried out on 150 x 300 mm size cylinder as per IS 5816 (1999).

RESULT AND DISCUSSION

The test results conducted on the conventional concrete cube as well as the cube with varying percentage of cement kiln waste and the strength at end curing days of 7, 14 and 28.

PROPERTIES OF CEMENT-KILN WASTE

Sl. No.	Properties	Values
1	Specific Gravity	2.96
2	Fineness Modulus	3.69

PROPERTIES OF FLY ASH

Sl. No.	Properties	Values
1	Specific Gravity	2.03
2	Fineness Modulus	20%retain

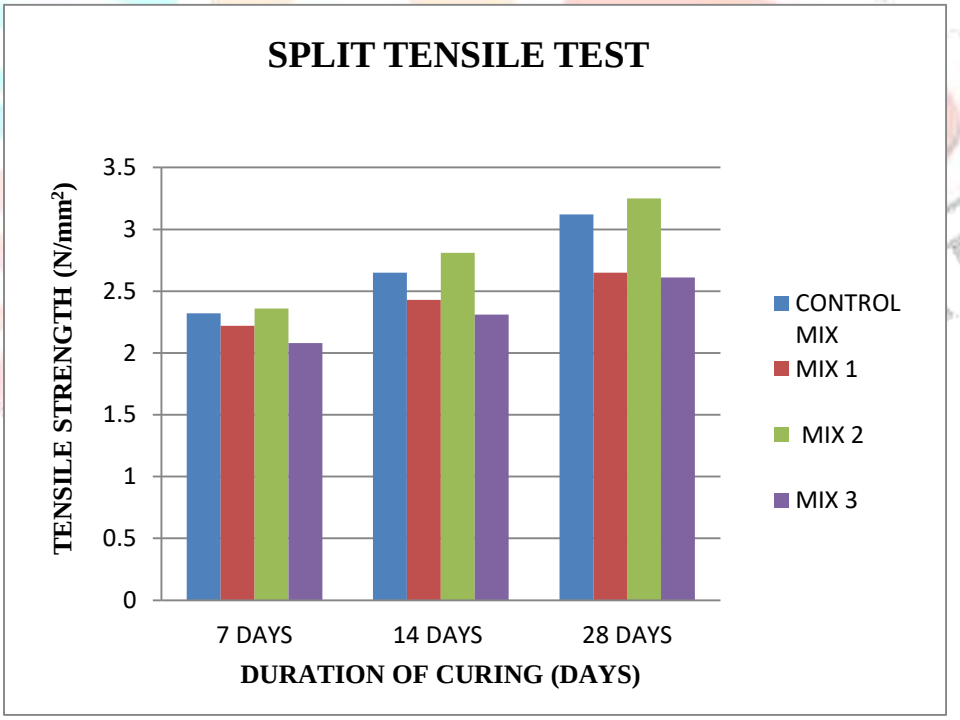
COMPRESSIVE STRENGTH TEST

The cubes are molded as per IS 10080 – 1982 and cured. The cubes were tested on 7th, 14th and 28th day as per IS 516 – 1959.

Types	Compressive strength in N/mm^2		
	7th day	14th day	28th day
Control mix	17.13	21.34	28.5
M1	14.39	18.21	24.32
M2	17.44	23.24	31.12
M3	16.13	20.17	26.23

SPLIT TENSILE TEST

The split tensile strength of the hardened concrete is nearly related to compressive strength of the specimen which was tested on 7th , 14th and 28th day of as per IS 516-1959. The dimension of cylinder mould is 150mm diameter and 300mm length



CONCLUSION

- The physical and chemical properties of cement, fine aggregate, coarse aggregate, fly ash, cement kiln waste are studied in this project.
- Mix design is prepared for M25 concrete, OPC 53 grade cement product is received from Ultra tech.
- The compressive strength, split tensile strength and flexural strength of concrete cubes, cylinders, and beams are casted and tested for various proportions of concrete mix. From the above test results strength of the concrete will be more in MIX 2 (i.e., 30% of cement is replaced by fly ash and 20% of fine aggregate is replaced by cement kiln waste) compare than the other mix.

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