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AN EXPERIMENTAL WORK ON CONCRETE BY USAGE OF CALCITE POWDER AS PARTIAL REPLACEMENT WITH CEMENT

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Abstract - *Calcite powder is natural form of calcium carbonate. This experiment described the procedure and result of a laboratory investigation of mechanical properties carried out on concrete specimen containing calcite powder as partial replacement of cement in concrete. Preparation of concrete specimens with calcite powder with different ratio by volume as replacement with cement. Find the best mechanical properties from the replacement of cement calcite powder separately and together. Test result indicate that the concrete specimens containing 10% calcite powder replacement by volume with cement separately and together improve the mechanical properties of the conventional concrete mixture. Indian Standard cube, cylinder and beam are prepared to measure compressive strength after 7days, 14days, and 28days and Split tensile, Flexural strength after 28days of water curing and compare this strength with M25 control mix.*

Key Words: Concrete, calcite powder, compression strength, split tensile strength, flexural strength.

1. Introduction

The most importance properties of concrete are mechanical strength. The mechanical properties of concrete can be improved with alternative material used for replacement of Portland cement in concrete. This material is more common due to some technical, economic and environmental reasons. One of this material is diatomaceous rocks. Diatomite is sedimentary rock of biogenic origin with high natural amorphous silica content. The amorphous silica is mainly in the form of diatom frustules, and secondarily in the form of sponge spicules, silicone-flagellate skeletons and radiolarian cells. This type of SiO2 can react with Ca(OH)2 and produce calcium silicate hydrates (C-S-H), which are responsible for the development of strength. Diatomite rocks commonly contain carbonate and clay minerals, quartz, feldspars and volcanic glass. it can be used as pozzolanic material for partial replacement of cement in production of concrete. Calcite powder is rock forming mineral with chemical formula with CaCO3. Calcite powder is natural form of calcium carbonate with extremely high witness, purity and Free flowing in nature.

2. Materials

2.1 Calcite powder

Calcite is a rock-forming mineral with a chemical formula of CaCO3. It is extremely common and found throughout the world in sedimentary, metamorphic, and igneous rocks. Some geologists consider it to be a "ubiquitous mineral" one that is found everywhere. Calcite is the principal constituent of limestone and marble. These rocks are extremely common and make up a significant portion of Earth's crust. They serve as one of the largest carbon repositories on our planet. The properties of calcite make it one of the most widely used minerals. It is used as a construction material, abrasive, agricultural soil treatment, construction aggregate, pigment, pharmaceutical and more. It has more uses than almost any other mineral.

Table 1 Chemical properties of calcite powder

SR. NO.	Particulars	Units	Results
1	Calcium carbonate as CaO	%	50.48
2	Magnesium oxide as MgO	%	2.42
3	Aluminum oxide as Al2O3	%	0.08
4	Ferric Oxide as Fe2O3	%	0.28
5	Calcium Carbonate as CaCO3	%	92.5
6	Magnesium Carbonate as	%	3.55
7	Silicon Di-Oxide As SiO2	%	5.3
8	Loss of Ignition	%	42.52

Table 2 Physiochemical properties of calcite powder

SR.NO	Particulars	Units	Results
1	Brightness	%	92.0
2	Whiteness	%	93.4
3	Bulk Density	Gm/cc	0.97

3. Mix Proportion for M25

Table 3 MIX Design

Volume of Concrete (Cu.m.)	1
Cement Content (kg)	394.64
Water Content (kg)	197.32
Fine aggregate (kg)	688
Kapachi (kg)	751
Grit (kg)	422
Admixture (kg)	0
Weight (kg)	2452.96
w/c ratio	0.5

4. Experimental study and test results

4.1 Aggregate impact value test

The "aggregate impact value" gives a relative measure of the resistance of an aggregate to sudden shock or impact, which in some aggregates differs from its resistance to a slow compressive load. This test is done on aggregate size passing 12.5 mm I.S sieve and retained on 10 mm I.S sieve.

Table 4 Aggregate impact value test result

	Sample 1	Sample 2
W1 = IS Sieve 12.50 mm passing & 10 mm retained oven dried weight	348 (gm)	350(gm)
W2 = IS Sieve 12.50 mm passing & 10 mm retained oven dried weight	51(gm)	55(gm)
W2/W1	0.1465	0.1571
(W2/W1) %	14.65 %	15.71 %

Fig -1 Aggregate impact value

4.2 Consistency of Cement

A Minimum quantity of water required to initiate the chemical reaction between water and cement to form a paste is known as consistency of cement. The Aim of this test is to find the basic required quantity of water to form a cement paste as specified by IS Code 4031 (Part 4 – 1988) which the Vicat plunger will penetrate to 5-7mm point to the bottom of Vicat mould.

Fig -2 Consistency of Cement

4.3 Compressive Strength Test

Tests used to determine the strength of concrete under applied loads. Testing is performed on a compression testing machine. It was done in accordance with IS 516-1959. In the case of a cubic compression test, a generally used test

piece uses a cube of 150 mm × 150 mm × 150 mm or 100 mm × 100 mm × 100 mm in consideration of the aggregate size. Typically, in most jobs, a die of 150 mm x 150 mm x 150 mm is used for the test. Cylindrical specimens are used for compression tests with a diameter of 150 mm and a height of 300 mm. For compression, a tamping rod of steel bar with a diameter of 16 mm and a length of 60 cm should be used.

Fig -3 ***Compressive Testing machine***

Fig -4 Cube ***Casting***

4.4 Split Tensile Strength

Generally, concrete is not designed to resist direct tensional force and also has a very low tensile strength. The obtaining of tensile strength of concrete is for getting the estimated load under crack occurrence. For maintaining the strength and continuity of the concrete member the importance to the crack which is developed should be given. Also, to prevent the corrosion of reinforcement, the crack occurrence should be minimized as the smaller crack develop in to the concrete structure leads to develop in larger crack which is the main reason for the corrosion of reinforcement. The behavior of reinforced concrete can be understand by the tensile strength in more case when, the tensile strength have not taken in consideration for actual design. The determination of tensile strength can be done by split tensile strength test of concrete. This test was done as per IS 5816-1970. A cylindrical mould of having standard size of 300 mm length and 150 mm diameter is used for the test. For the casting procedure the cylindrical mould is filled by concrete mix in 3 layers of having equal depth approximately. A tamping rod of steel bar having 16 mm diameter and 60 cm long and bullet pointed at lower end should be use for compaction. The concrete distribution should be uniformly throughout the mould by hand tamping or using mechanical vibrator for compaction. Each layer of the concrete should be compacted well and the compaction should not be less than 35 strokes per layer using tamping rod. Then after the leveling of top surface should be done and make the surface smooth by using trowel. Then after, the test specimens are removed from the moulds after 24 hours and kept in the water until the test is carried out.

Fig -5 cylinder ***Casting***

4.5 Flexural strength test

Flexural strength test. The determination of tensile strength by flexural test is the ideal method because of its similarity to the real life situations which are faced by flexural members. In the flexural test, the specimen of concrete is loaded on simply supported as shown in the figure. There are two various types of loading is generally applied to the test specimen either at the midpoint of the test specimen or at two equidistant points of the test specimen from the ends. The arrangement of the flexural test is shown in figure.

Generally, the standard size of beam specimen is 150 mm x 150 mm x 700 mm but another size of beam specimens 100 mm x 100 mm x 500 mm is used for the testing purpose when the aggregate size is lower. The beam failure occurs in bending when the acting stress at the bottom surface of the beam exceeds the limit and it is termed as modulus of rupture.

Fig -6 Beam *Casting*

4.6 Results

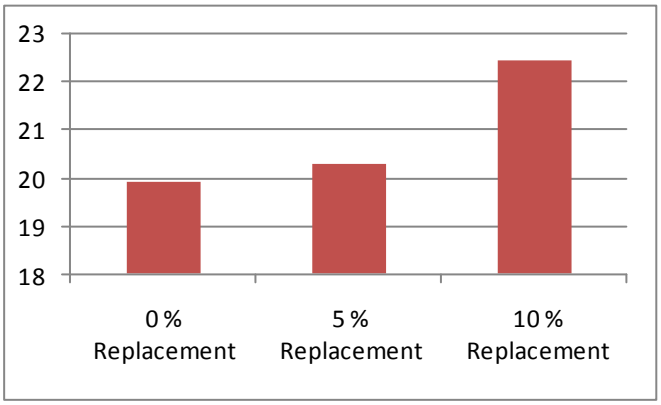

Chart -1: Compressive strength of cube after 7 days

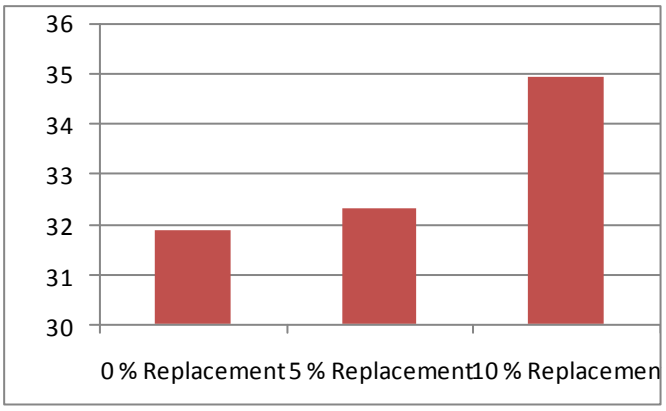

Chart -2: Compressive strength of cube after 28 days

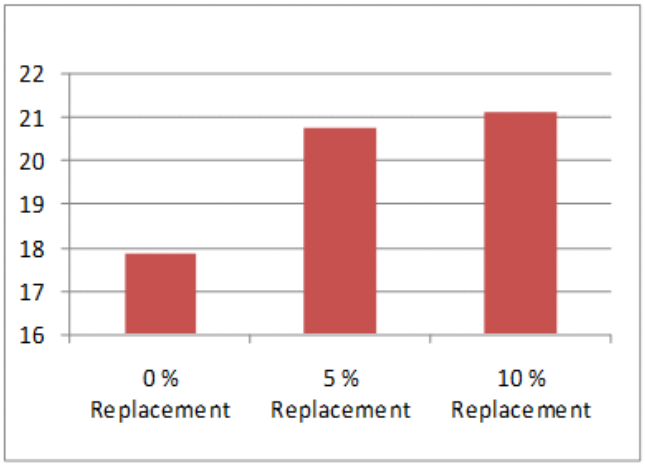

Chart -3: Compressive strength of cylinder after 7 days

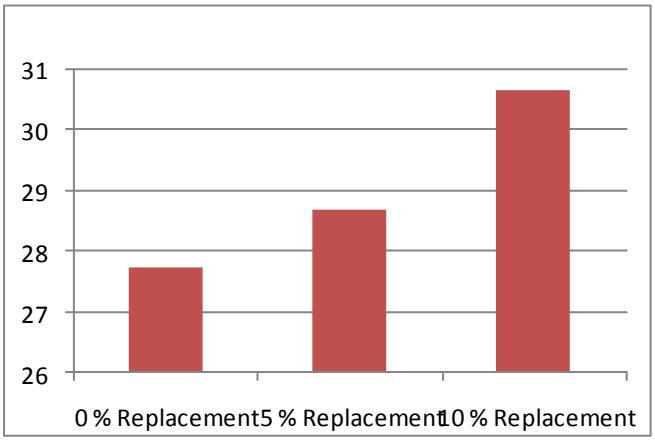

Chart -4: Compressive strength of cylinder after 28 days

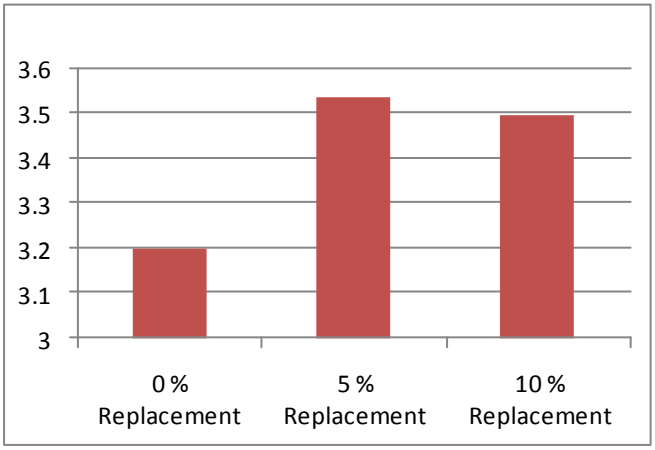

Chart -5: Split Tensile strength of cylinder after 28 days

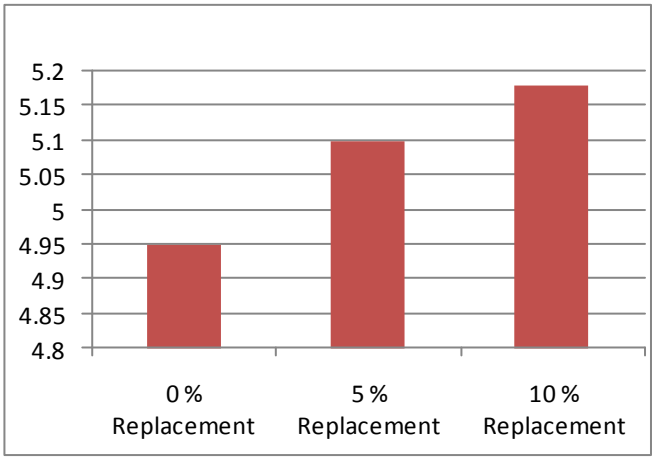

Chart -6: Flexure strength of Beam after 28 days

5. CONCLUSIONS

The replacement of calcite powder with cement gives improvement in compression strength and split tensile strength. here I show some results for compressive strength and split tensile strength. with 10% calcite powder replace with cement give maximum compressive strength 34.93 N/mm^2 and 5% calcite powder replace with cement give maximum split tensile strength 3.54 N/mm^2 this mix proportion are given maximum result for compressive strength and split tensile strength.

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