

Experimental Investigation on Rich Mineral Silican(Ecosand) in Concrete

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ABSTRACT: Silica mineral (Ecosand) being a waste material generated from manufacture of cement from industry. It can be used to increases efficiency in concrete. An experimental study has been done to achieve high strength concrete using silica mineral (Ecosand) from manufacture of cement as the partial replacement of natural sand (upto 50%) in concrete and studied its mechanical properties .Experimental results are also shows that the compressive strength, flexural strength, splitting tensile strength and structural behaviour of beam of silica mineral (Ecosand) and natural sand such that the combination of two aggregate can be increased efficiency in concrete. The combined grading of fine aggregate of tested results shows closest to zone III and zone IV

KEYWORDS: Ecosand, Limestone

I. INTRODUCTION

In its simplest form, concrete is a mixture of paste and aggregates. The paste, composed of Portland cement and water, coats the surface of the fine and coarse aggregates. Through a chemical reaction called hydration, the paste hardens and gains strength to form the rock- like mass known as concrete. Within this process lies the key to a remarkable trait of concrete: it's plastic, malleable and can be shaped when newly mixed, strong, retains shape and durable when hardened. The key to achieving a strong, durable concrete rests in the careful proportioning and mixing of the ingredients.

A concrete mixture that does not have enough paste to fill all the voids between the aggregate will be difficult to place and will produce rough, honeycombed surfaces and porous concrete. A mixture with an excess of cement paste will be easy to place and will produce a smooth surface: however, the resulting concrete is likely to shrink more and be uneconomical. A properly design concrete mixture will possess the desired workability for the fresh concrete and the required durability and strength for the hardened concrete. Typically, a mix is about 15 to 20 percent cement, 60 to 75 percent aggregate and 5 to 10 percent water. Cement is used in making cement concrete. It is very popular convenient product finding a place in most type of construction.

II.MATERIALS AND METHODS

The material used for this experimental work are cement, sand, water, steel fibers, and super plasticizer.

Cement:

Cement is a binder that sets and hardens and can bind other materials together. Ordinary Portland Cement (OPC) 53 grade is used. Cement is a binder that sets and hardens and can bind other materials together. A powdery substance made by claiming lime and clay, mixed with water to form mortar or mixed with sand, gravel and water to make concrete.

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Fine aggregate:

The specific gravity of fine aggregate was 2.6.

Coarse aggregate:

Angular shape aggregate which passes through 20 mm sieve and retain on 10mm are used as coarse aggregate in this project work. The specific gravity of coarse aggregate was 2.64 and fineness modulus of 7 was found out 12.5mm.

Eco sand:

Eco sand are very fine particles, a bi-product from cement manufacture which can be used to increase efficiency in concrete. Eco sand is finally powered crystalline silica which can replace up to a varying percentage of conventional sand usage in concrete and mortars. Required no water change, no filters ,no pipes leakage.

Mix design :

The mix design of M20 grade concrete is calculated using IS 456-2000 and IS 10262-2009.The material required as per design are given in Table: 1

Materials	W/C ratio	Cement	Fine aggregate	Coarse aggregate
Ratio	0.45	1	1.6	2.4

TABLE: 1 Material required as per is method of design

III. TESTING METHODS

To determine the hardened properties of concrete standard tests like compression test on cubes for compressive strength, split tensile test on cylinders for tensile strength and flexural test on beams for flexural strength of concrete were carried out at 7days and 28days of curing.

PREPARATION OF SPECIMAN:

For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for M20 grade of concrete. The moulds were filled with 0%, 10%, 20%, 30%,40%and 50% Ecosand. Vibration was given to the moulds using table vibrator. The top surface of the specimen was levelled and finished. After 24 hours thespecimens were demoulded and were transferred to curing tank where in they were allowed to cure for 7 and 28days.

COMPRESSIVE STRENGTH:

After 7 and 28 days curing, these cubes were tested on digital compression testing machine as per I.S. 516-1959. The failure load was noted. In each category three cubes were tested and their average value is reported. The compressive strength was calculated as follows in Table: 2 and Figure: 1

Compressive strength (MPa) = Failure load / cross sectional area.

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TABLE 2: COMPRESSIVE STRENGTH OF CONCRETE CUBES

% of ECOSAND	Compressive strength N/mm ²	
	7 days	28days
0%	17.48	22.4
10%	17.62	23.96
20%	17.41	24.13
30 %	20.56	24.74
40%	22.42	25.34
50%	23.01	29.02

Compressive strength

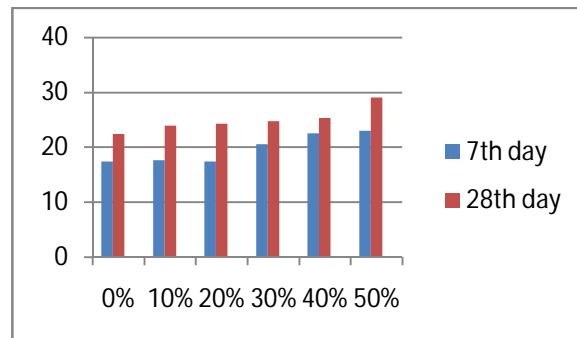


Figure1:various %of compressive strength

This graph represents the compressive strength of concrete for 7 days and 28 days from various percentage of ecosand using. Ecosand has the highest value of strength (23.01Mba for 7 days and 29.02Mba for 28 days)

SPLIT TENSILE STRENGTH OF CONCRETE CYLINDERS

For Split tensile strength test, cylinder specimens of dimension 150 mm diameter and 300 mm length were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank wherein they were allowed to cure for 28 days. These specimens were tested under compression testing machine. In each category three cylinders were tested and their average value is reported.

Split Tensile strength was calculated as follows in Table :3 and chart in Figure :2

Split Tensile strength (MPa) = $2P / \pi DL$, Where, P = failure load, D = diameter of cylinder, L = length of cylinder

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TABLE 3: SPLIT TENSILE STRENGTH OF CONCRETE CYLINDERS

% of Ecosand	Spilt tensile strength N/mm ²	
	7 days	28days
0%	0.85	2.68
10%	1.1	2.87
20%	1.61	3.09
30%	1.87	3.56
40%	2.12	4.09
50%	2.38	4.38

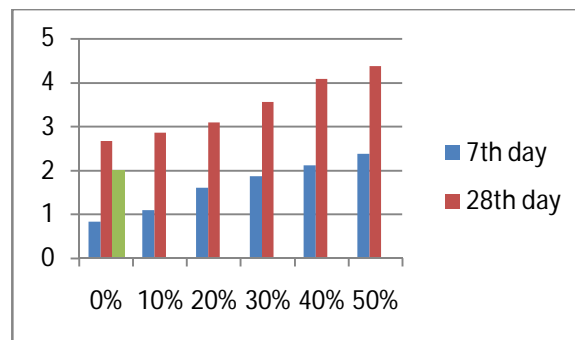


Figure2:various % of split tensile strength

This graph represents the split tensile strength of concrete for 7 days and 28 days from various percentage of ecosand using. Ecosand has the highest value of strength (2.38Mba for 7 days and 4.38Mba for 28 days)

FLEXURAL STRENGTH OF CONCRETE BEAMS

For flexural strength test beam specimens of dimension 1600x150x100 mm were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank wherein they were allowed to cure for 28 days. These flexural strength specimens were tested under two point loading as per I.S. 516-1959, over an effective span of 400 mm on Flexural testing machine. Load and corresponding deflections were noted up to failure. In each category three beams were tested and their average value is reported.

The flexural strength was calculated as follows in Table : 4 and chart in Figure : 3

$$\text{Flexural strength (MPa)} = PL / bd^2$$

Where,

P = Failure load,

L = Centre to center distance between the support = 400 mm,

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b = width of specimen=150 mm,
d = depth of specimen= 100 mm.

TABLE 4: FLEXURAL STRENGTH OF CONCRETE BEAMS

% of fiber	Flexural strength (N/mm ²)
	28 days
0 %	4.8
10%	5.5
20%	6.0
30 %	6.7
40%	7.5
50%	8.1

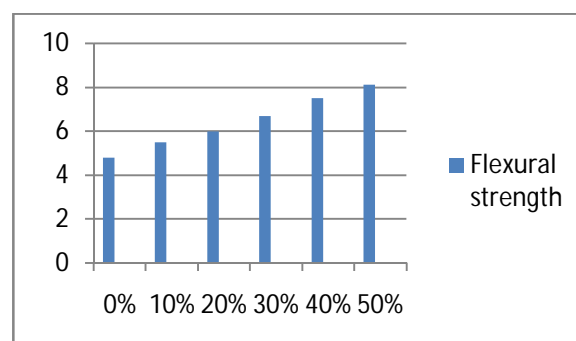


Figure2:various % flexural strength

IV. CONCLUSION

- Eco sandbeing industrial by product can be used as partial replacement of fine aggregate in concrete.The combined grading of fine aggregate confirms better packing pattern.
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- The cube compressive strength, cylinder split tensile strength, prism flexural strength obtained by using the combination of fine aggregate and Eco sand gives a higher value up to 50%
- Low frictional resistance of Eco sand will increase the workability of concrete and hence will reduce admixture requirement
- The low rates of these industrial by product and also increase in rate of sand day by day shows that usage of these material will prove cheaper.

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