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AN EXPERIMETAL INVESTIGATION OF HIGHER STRENGTH CONCRETE ON PARTIAL REPLACEMENT OF CEMENT BY ZEOLITE

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Abstract -: *Green house gases are the major causes in global warming .The green house gases are like, Co_2, N_2O, CH_4 they let the untidy warming. In current co_2 levels were increases 100ppm than last million years. In global carbon emission researches were find burning fossil fuel by comparing co_2 level 1.6% in 2017 and it has increased 2.7% in 2018,and usage of cement in construction purpose they given 1 tone cement can produces 1.25 tones of co_2 gases. The overall cement contribution given an impact of 7% of co_2 emissions for global warming.Man investigation carried out for alternative method to rectifying and control co_2 emissions for reducing cement usage. Recently some articles are focused on zeolite powder as a partial replacement of cement. zeolites is a alumino- silicate material they have to be a better option for a partial replacement of cement and they have pozzolanic reaction slower than cements hydration.An investigation explained the mechanical properties of zeolites and the analysis carried out M30 grade of concrete in percentage of addition of zeolites of 0%.5%,10%,15%,20%.Concrete with zeolite as partial replacement material, absorb destructive gases and gives high compressive strength hence it is ecological.*

Key Words: Zeolite, compressive strength, flexural strength, Split tensile strength.

1.INTRODUCTION

Concrete is constructional material composed cement, fine aggregate and coarse aggregate mixed with water which hardens with time. Portland cement is the commonly used type of production of concrete. Concrete technology deals with study of propreties of concrete and its practical application .In building constructional, concrete use for the construction of foundations, colmns ,beams, slab and load bearing elements. There are different types of building material is used other than cement such as lime concrete and bitumen for asphalt concrete which is used for road construction.

ZEOLITE is used to make durable concrete structures in combination with ordinary Portland cement and other pozzolanic materials. ZEOLITES has been widely used in Europe, and increasingly in the United States and in Asia (particularly in Japan and Singapore) for its superiority in concrete durability, extending the lifespan of buildings from fifty years to a hundred years. Natural zeolites are useful industrial mineral with exciting surface and structural properties. It has been used widely for various purposes in industrial, agricultural, environmental and biological technology..

2.Materials used

2.1 Ordinary Portland cement

Cement is the most important ingredient of concrete. One of the important criteria for the selection of cement is its ability to produce improved microstructure in concrete.OPC 53 grade cement gives 28 days compressive strength is 53N/MM_2 Physical Properties of cement used are given in table 1.

Table -1: Properties of OPC 53 cement

Property	Result
Specific gravity	3.11
Consistency	33%
Initial settling time	30 min
Final settling time	320min

1.1.1 Zeolite

2.2Zeolite powder

Zeolites are volcanic rock by products they are alumino -silicate pozzolonoics material. Zeolite are does in prevent the green gases in global warming. Some physical properties of zeolites are follows.

Table -2 : Physical properties of zeolite

S.no	Property	Value
1	Specific gravity	2.2

2.3: Fine aggregate

The fine aggregate used stayed locally available and conforming to Zone-IV grading requirements of IS:383:1970

Table - 3 : Properties of fine Aggregate

S.no	Test for fine aggregate	Result
1	Fineness modulus	3.356(zone-4)
2	Specific gravity	2.87
3	Water absorption	1%

2.4: Coarse aggregate

The coarse aggregates used was nearby available crushed natural stone of size 20 mm.

Table – 4 : Properties of coarse aggregate

S.no	Test for coarse aggregate	Result
1	Fineness modulus	7.40
2	Specific gravity	2.74
3	Water absorption	0.50%

2.5 Mix proportion

The experimental program was based on reference cementThe mix of grade is M30 using natural aggregate Material properties concrete mix was1: 1.94:3.91

2.6 Preparation of test specimens

- Pan-mixingis adopted throughout the experimental work. First the materials cement, Fine aggregate, coarse aggregate, weighed accurately.pan mixer is used as a capacity of 1 cu.f t.The drum is made of steel plates with a number of blades put in inclined position in the drum.
- Make the fresh concrete by replacing of cement by zeolite in different %, such as 0%, 5%, 10%, 15%, 20%.
- After conducting workability tests, pour the concrete into moulds and ensure proper compaction.

3.TESTING OF CONCRETE

- The testing of concrete were fresh and harden concrete test are adequate to find the strength of concrete. Follows are the testes
- Concrete cubes of size 150x150x150 mm were tested for compressive strength as per IS:516:1959.
- For flexural strength,beam specimens of size 500x500x100 mm were tested ,as per IS:516:1959.
- Split tensile strength of specimens of sizes in cylinder are diameter 150mm,and height are300mm as per IS:516:1959.

2.TEST RESULTS AND DISCUSSIONS

2.1Workability test

- Unsupported concrete, when it is FRESH, will flow to the sides and a sinking in height will take place. This vertical settlement is known as SLUMP. Slump is a measure indicating the consistency or workability of cement concrete. It gives an idea of water content needed for concrete to be used for different works. A concrete is said to be workable if it can be easily mixed and easily placed, compacted and finished
- A workable concrete should not show any segregation or bleeding. Slump increases as water-cement ratio increases. Slump test is the most commonly used method of measuring consistency of concrete which can be employed either in laboratory or in site of work. It is not a suitable method for very wet or very dry concrete. Workability concrete test results in table 5.

Table 5 : Workability test results

% replacement of cement by zeolite	Slump(mm)			Flow %
0%	115	0.95	3	60
5%	109	0.94	3	60
10%	106	0.94	3	52
15%	103	0.96	4	48
20%	101	0.93	4	48

2.2Compressive strength test

- In the design of concrete mixes, the compressive strength of concrete is generally the main target since it usually represents an overall picture of quality of concrete. The compressive strength is the maximum load per unit area sustained by a concrete before failure a function of summation of product of time and temperature .this summation is called maturity of concrete. in table 7.

- The cube specimens cured as above are tested as per standard procedure after removal from the curing tank and allowed to a dry under shade. The cube specimens tested under microprocessor based compression testing machine of 2000KN capacity. The results are tabulated in table.
- Compressive strength is ranged from 18.13 MPa to 23.13 MPa at the age of 7 days. At the age of 28 days it was varied from 28.68 MPa to 34.13 MPa

Table 6: Compressive strength test results

S.NO	PERCENTAGE OF ZEOLITES ADDED	COMPRESSIVE STRENGTH N/MM2	
		7 DAYS	28DAYS
1	0%	20.8	29.91
2	5%	36.89	35.55
3	10%	27.5	52.44
4	15%	19.5	44.11
5	20%	20.6	32.22

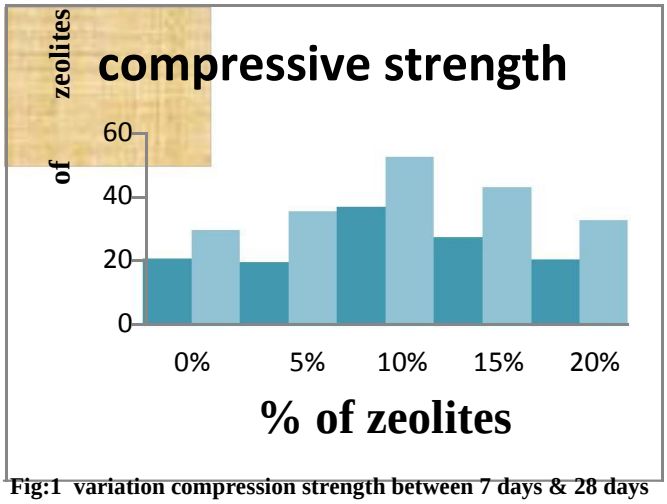

Fig:1 variation compression strength between 7 days & 28 days

2.3Flexural strength test

- During the testing, the beam specimens of size 50mmx10mmx50mm were used. Specimens were dried in open air after 7 days of curing and subjected to flexural strength test under flexural testing assembly. Apply the load at a rate that constantly increases the maximum stress until rupture occurs. The fracture indicates in the tension surface within the middle Third of span length. The flexural strength was obtained using the formula (R)

$$R = Pl/bd^2$$

Where,
R = Modulus of rupture (N/mm2)
P = Maximum applied load (N/mm2)
l = Length of specimen (mm)
b = Width of specimen (mm)
d = depth of specimen (mm)

- Flexural strength, also known as modulus of rupture, bend strength, or fracture strength, a mechanical parameter for brittle material, is defined as a material's ability to resist deformation under load. The transverse bending test is most frequently employed, in which a specimen having either a circular or rectangular cross-section is bent until fracture or yielding using a three point flexural test technique

Table: Flexural strength test results

S.NO	PERCENTAGE OF ZEOLITES ADDED	FLEXURAL STRENGTH N/MM2	
		7 DAY S	28DAYS
1	0%	1.2	1.4
2	5%	1.3	1.2
3	10%	1.4	1.6
4	15%	1.1	1.1
5	20%	1.2	1.2

Table 8 : Flexral strength test results

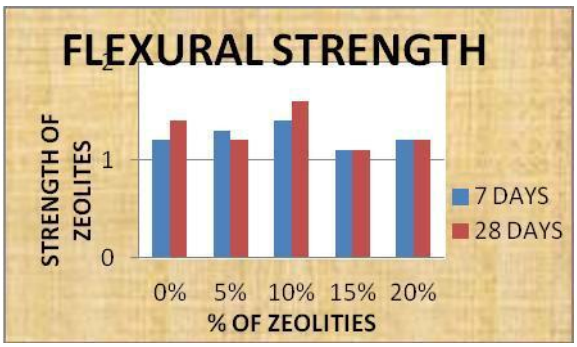

Fig.2: Variation of flexural strength.

2.4Split tensile strength test

The test is carried out by placing a cylindrical specimen horizontally between unfaces of a compression testing machine and the diameter.

S.NO	PERCENTAGE OF ZEOLITES ADDED	SPLIT TENSILE STRENGTH N/MM2	
		7 DAYS	28 DAYS
1	0%	2.12	3.13
2	5%	2.68	3.25
3	10%	2.97	4.66
4	15%	2.71	3.96
5	20%	2.44	3.33

Table 9 : Split tensile strength test results

Splitting tensile strength of zeolites concrete is ranged from 1.98 MPa to 2.97 MPa at the age of 7 days. At the age of 28 days it was varied from 2.07MPa to 3.01MPa

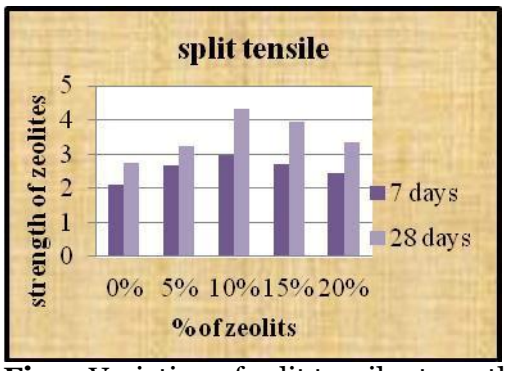

Fig.3: Variation of split tensile strength

CONCLUSIONS

1. The compressive strength increased as the percentage of addition increased ,but zeolites powder concrete established marginally higher compressive strength than those of without zeolite powder concrete.
2. The concrete cubes that are replaced with zeolite powder which are placed in dirty environment the weight of the cubes increases with innovative weight.
3. The results would have been better on submission of rushed CO_2 and moist temperature which is more favorable CO_2 curing
4. The assertiveness of CO_2 as waste and pollutant would change as a source for liberal construction.
5. The optimum percentage of partial replacement of cement with zeolite powder strength achieved by 10

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