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STUDY ON CO_2 ABSORBING RIGID PAVEMENT

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***Abstract*—Due to vast growing of population and traffic, environment serious issues like pollution, de-forestation, global warming , greenhouse gases emission is more such as hydrocarbons, nitrogen oxides, carbon monoxides, sulphur dioxide and CO_2 which are causing lungs irritation, respiratory problems , infections such as pneumonia for human beings .To overcome this problem in this paper an attempt has been made to absorb CO_2 from environment by constructing the Rigid Pavement using Zeolite as a admixture in concrete.**

The building industry CO_2 emission is mainly comes from cement production capturing of CO_2 from point of source from ambient air and reducing concentration by using zeolite powder. Concrete with zeolite has a supplement material can absorb large quantity of CO_2. Generally zeolite is porous hydrated alumina silicate they may be minerals, synthetic minerals.

Introducing zeolite materials into the concrete blocks absorbs CO_2 from the atmosphere. Hence it will be ecofriendly. Absorbs CO_2, reduces the air pollution and keep environment clean and full of oxygen and also increases the compressive strength of concrete.

Keywords— **Zeolite, Carbon dioxide, Strength, Environment, Pollution.**

I. INTRODUCTION

Due to uncontrolled urbanization in India, environmental degradation has been occurring very rapidly and causing many problems like land insecurity, worsening of water quality, air pollution, Noise pollution etc. In that air pollution is a major problem. The sources of air pollution includes ammonia, CO, CO_2, SO_2 etc. In this paper an attempt has been made to absorb CO_2 from atmosphere by using Zeolite as a admixture in concrete. Zeolite is manufactured in factories. This kind of material has property to absorb CO_2 with incredible strength. Because of this nature this material can be substituted in place of aggregate. The Zeolite is available in powder as well as in fine aggregates form which can be used to replace sand and cement in concrete in planting the property to absorb CO_2 from the atmosphere. This type of material is easily available in market. As the material literally costly even here the replacement is made only up to certain extent so that this will be affordable.

II. MATERIALS AND METHODOLOGY

A. Methodology –

Present work consists of following methodology which is shown in Fig. 1.

Fig. 1. Methodology

The materials used for the work are Cement, M sand, Coarse Aggregate, Water and Zeolite as a admixture in concrete.

B. Materials –

Zeolite: The classical definition of a zeolite is a crystalline, porous aluminosilicate. However, some relatively recent discoveries of materials virtually identical to the classical zeolite, but consisting of oxide structures with elements other than silicon and aluminum have stretched the definition.

Table 1. Chemical Composition of Zeolite

Chemical Composition	Zeolite (%)
SiO2	63.9413
CaO	2.9563
MgO	0.5211
Na2O	1.9606
K2O	0.2847
Fe2O3	2.3314
Al_2O3	13.221
SO3	0.0413
Cl^-	0.0145
L.O.I	13.8208
Total %	99.6337

Cement: Cement is of 43 grade Ordinary Portland Cement conforming to BIS 12269-1987 was used.

Table 2. Cement Test Results

Properties	Results
Specific gravity	3.12
Finess of Cement	97%
Standard consistency test	35%
Initial setting time test	75Min

M-Sand: Those fractions from 4.75mm to 150 microns are termed as fine aggregate. The crushed sand is to be used as fine aggregate conforming to the requirements of IS: 383.

Table 3. M-Sand Test Results

Properties	Results
Specific gravity	2.74
Gradation	Zone-I
Water absorption	1%

Coarse Aggregate: Coarse aggregates of size above 4.75 mm Sieve and below 20mm are used.

Table 4. Coarse Aggregate Test Results

Chemical Composition	Zeolite (%)
SiO2	63.9413
CaO	2.9563
MgO	0.5211
Na2O	1.9606
K2O	0.2847
Fe2O3	2.3314

III. TEST ON CONCRETE

Concrete is designed for M-40 grade. The following table shows compressive strength of normal concrete cube for M 40 Mix design for average of 7, 14 and 28 days.

Table 5. Compressive Strength of Normal Concrete Cube

Sample	7 days		14 days		28 days	
	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)
Cube 1	738	32.8	1055.25	46.9	1145.25	50.9
Cube 2	744.75	33.1	1039.50	46.2	1154.25	51.3
Cube 3	765.0	34.0	1075.5	47.8	1127.25	50.1
Average	749.25	33.3	1056.75	46.96	1181.25	50.76

Table 6. Comp; Strength of Concrete Cube with 10% Zeolite

Sample	7 days		14 days		28 days	
	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)
Cube 1	805.5	35.8	1089.0	48.4	805.5	35.8
Cube 2	771.75	34.3	1077.75	47.9	771.75	34.3
Cube 3	789.75	35.1	1098.0	48.8	789.75	35.1
Average	789.0	35.06	1088.25	48.36	789.0	35.06

Table 7. Comp; Strength of Concrete Cube with 20% Zeolite

Sample	7 days		14 days		28 days	
	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)
Cube 1	699.75	31.1	969.75	43.1	699.75	31.1
Cube 2	715.50	31.8	947.25	42.1	715.50	31.8
Cube 3	679.5	30.2	940.5	41.8	679.5	30.2
Average	698.25	31.03	952.5	42.33	698.25	31.03

Table 8. Comp; Strength of Concrete Cube with 30% Zeolite

Sample	7 days		14 days		28 days	
	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)	Load (KN)	Strength (MPa)
Cube 1	630.00	28.00	924.75	41.10	992.25	44.10
Cube 2	636.75	28.30	900.00	40.00	978.75	43.50
Cube 3	652.50	29.00	895.50	39.80	963.00	42.80
Average	639.75	28.43	906.75	40.40	978.00	43.46

Table 9. Average Comp; Strength of Normal Concrete and Zeolite Concrete Cubes

Type of concrete	Compressive strength in Mpa		
	7 days	14 days	28 days
Normal concrete	33.30	46.96	50.76
10% Zeolite concrete	35.06	48.38	52.50
20% Zeolite concrete	31.03	42.33	46.50
30% Zeolite concrete	28.43	40.40	43.46

CO2 Absorption test by Weight of Cube: The absorption of CO2 is measured by increased weight of cubes after 28 days of curing. Weight of Concrete Cubes is shown in Table No. 10

Table 10. Average Weight observation values of Zeolite and Normal Concrete Blocks.

	Block 1 (10% Zeolite)	Block 2 (20% Zeolite)	Block 3 (30% Zeolite)	Block 4 (Normal block)
Initial weight of block (kg)	9.150	9.020	9.045	9.275
Weight of block on 5th day (kg)	9.135	8.995	9.025	9.250
Weight of block on 10th day (kg)	9.120	8.985	9.004	9.243
Weight of block on 15th day (kg)	9.090	8.980	8.980	9.235
Weight of block on 20th day (kg)	9.085	8.975	8.975	9.232
Weight of block on 25th day (kg)	9.074	8.961	8.976	9.220
Weight of block on 30th day (kg)	9.076	8.963	8.978	9.218
Weight of block on 35th day (kg)	9.076	8.965	8.981	9.218
Weight of block on 40th day (kg)	9.078	8.966	8.982	9.218
Weight of block on 45th day (kg)	9.079	8.968	8.984	9.218
Weight of block on 50th day (kg)	9.082	8.973	8.989	9.218

Figure 2 shows Graphical representation of Average Compressive Strength of Normal Concrete and Zeolite Concrete Cubes

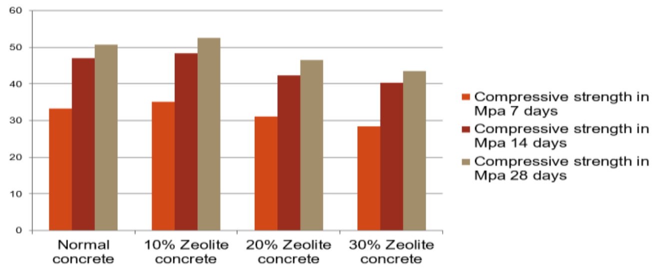

Fig. 2. Comparison Chart

Table 11. Amount of CO2 Absorbed by Zeolite Cubes

Sl. No.	Block Number	Amount of CO2 Absorbed (Moles)
1	B1 (10% zeolite)	0.136
2	B2 (20% zeolite)	0.181
3	B3 (30% zeolite)	0.250
4	B4 (Normal block)	0.000

IV. CONCLUSION

Construction of CC pavement with Zeolite powder will absorb some amount of CO2 from atmosphere intern it reduces the air pollution to some extent.

From the compressive strength results it is observed that cubes with zeolite powder have achieved little high strength at 10% replacement of zeolite powder when compared to normal concrete, so that the optimum content of zeolite to be used as mineral admixture is 10% more than that will decrease the compressive strength concrete.

Increase in zeolite content than optimum value will increase absorption rate of CO2 but decreases compressive strength.

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