Study on Carbon Dioxide (CO_2) Absorbing Concrete

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Abstract - In order to overcome serious climate change, deep reduction in co2 emission will be required in coming decades. Co2 absorption is one of the key technologies to control the global warming. Global warming is caused by sharply increased greenhouse gases emission by human activities. In building, industry co2 emission mainly come from cement production. In the experimental study, a feasibility study is made to use zeolite as an admixture to an already replaced Cement with (Portland Pozzolana Cement) in Concrete, and an attempt has been made to investigate the strength parameters of concrete (Compressive strength). For control concrete, IS method of M30 is adopted and considering this a basis, mix design for replacement method has been made. Three different replacement levels namely 10%,20% and 30% are chosen for study concern to replacement

Keywords – Zeolite

1 INTRODUCTION

As it is been found that obtuse quantity of CO2 gets expelled from construction; impeding it would definitely reduce total percentage of CO2 emission. This emission should be stopped and CO2 from the air must be diminished putting this as a main soul we are designing a concrete (which is main constituent of construction) by taking Zeolite as a rationale. This Zeolite substitute for cement will consequently absorb the CO2. Zeolite is manufactured in factories. This kind of material has property to absorb CO2 with incredible strength. Because of this nature this material can be substituted in place of cement. 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. Deliberating all these problems and properties of this material we are making this CO2 absorbing. Rather than disposing such materials, utilization in various types of cement of concrete such as " CO2 absorbing concrete" can ultimately reduce the environment pollution and also help to establish CO2 less zonal atmosphere

Carbon capture and utilization for concrete production (CCU concrete) is estimated to sequester 0.1 to 1.4 gigatons of carbon dioxide (CO_2) by 2050. However, existing estimates do not account for the CO_2 impact from the capture, transport and utilization of CO_2, change in compressive strength in CCU concrete and uncertainty and variability in CCU concrete production processes. By accounting for these factors, we determine the net CO_2 benefit when CCU concrete produced from CO_2 curing and mixing substitutes for conventional concrete.

2. STUDY AREA & DATA COLLECTIONS

2.1 Cement

In this present work Portland pozzolona cement confirming to IS 1489:1991 was used. This type of cement is obtained by grounding the Portland cement clinker with fine pozzolanic material and adding possible amount of gypsum. The properties of cement are shown below

Table 1 Physical Properties of Cement

S. No	Property	Value
1	Specific gravity	2.74
2	Standard consistency	35%
3	Initial setting time	40min

2.2 Zeolite

Zeolite is a rock composed of micro porous alumina silicates, and oxygen. It occurs naturally in several regions of the world where volcanic activity has occurred near water. Since they're unreactive and based on naturally occurring minerals, they're not believed to have any harmful environmental impacts.

Table 2 Physical Properties of Zeolite

S. No	Property	value
1	Specific gravity	2.3

Ziolite

2.3 Coarse Aggregate

Coarse aggregates of sizes 20 mm were used confirming to IS383.1970.the various aggregate properties were tested accordingly and their value are shown below in Table

Table 3 Physical Properties of Coarse aggregate

S. No	Property	Value
1	Specific gravity	2.80
2	Water absorption	1.1
3	Bulk density in loose state	1414 kg/m^3
4	Bulk density in compacted state	1550 kg/m^3

2.4 Fine Aggregate

Fine aggregate having the size less than 2.36mm, these are generally used in preparation of concrete, as it in parametric material.

Table 4 Physical Properties of Fine Aggregate

S. No	Property	Value
1	Specific gravity	2.61
2	Water absorption	1.2
3	Fineness modulus	2.4
4	Bulk Density in loose state	1597 kg/m^3
5	Bulk Density in compacted state	1700 kg/m^3

2.5 Water

Water mixing of concrete and curing of the prepared specimens was done using water available in college premises.

3 METHODOLOGY

In present study M30 grade concrete were designed as per IS: 10262-2009

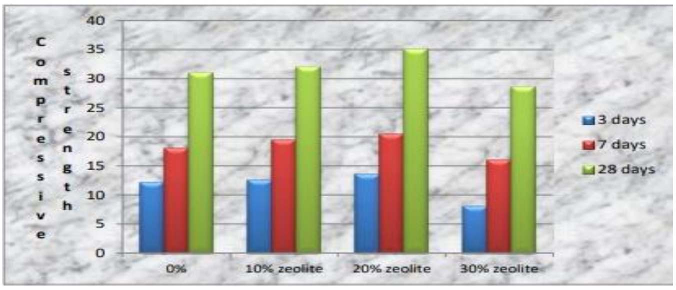
3.1 Compressive Strength

The specimens were cast and tested as per IS: 516-1959.In this investigation, M30 mix concrete is considered to perform the test by-weight basis with 0%,10%,20% and 30% of cement replaced by Zeolite.A 150x150 mm concrete cube was used as test specimens to determine the compressive strength of concrete cubes. The ingredients of concrete were thoroughly mixed till uniform consistency was achieved. The cubes were properly compacted. All the concrete cubes were de-moulded within 24 hours after casting. The demoulded test specimens were properly cured in water available in the laboratory at an age of 28 days. Compression test was conducted on a 2000KN capacity universal testing machine. The load is applied without shock and increased continuously at a rate of approximately 140 kg/sq cm/min.

Table 5 Compressive strength for 3,7 &28 days for various mix proportions

S. No	Percentage of Replacement	No Of Days Cubes Are Tested	Avg. Compressive Strength N/mm2
1	0%	3	12
		7	18
		28	31

2	10% Zeolite	3	12.5
		7	19.5
		28	32
3	20% Zeolite	3	13.5
		7	20.5
		28	35
4	30% Zeolite	3	8
		7	16
		28	28.5

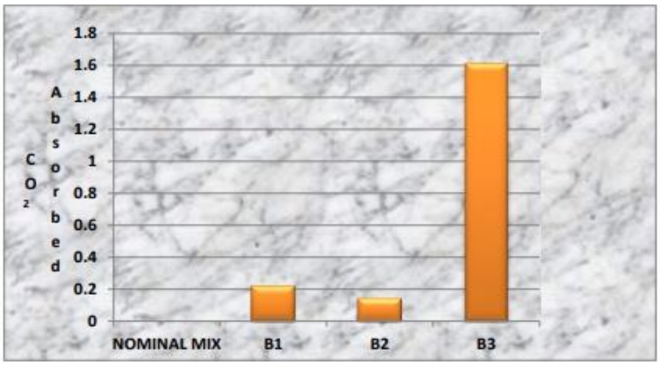


Compressive Strength Different Ziolite Mixes

3.2 Test on Ziolite Block

Calculation of CO2 absorbed by blocks= Final Weight – Initial weight/Molecular weight of CO2.
CO2 absorbed by B1= 755-745/44 =0.22 mole
CO2 absorbed by B2= 741-735/44 = 0.14mole
CO2 absorbed by B3= 828-757/44 = 1.61mole

S. No	Block Number	Amount Of CO2 Absorbed(Mole)
1	B0	0
2	B1(10% zeolite)	0.22
3	B2(20% zeolite)	0.14
4	B3(30% zeolite)	1.61



Amount of CO2 Absorbed for Nominal,10,20, 30% Zeolite Powder

4. CONCLUSION

Based on the experimental results and their plots and subsequent discussion on the results the following conclusions are drawn.

- The compressive strength increased as the percentage of addition increased, but zeolite powder concrete developed slightly higher compressive strength than those of without zeolite powder concrete.
- The concrete cubes that are replaced with zeolite powder which are placed in polluted environment the weight of the cubes increases with original weight.
- From the above compressive strength results, it is observed that zeolite powder based concretes have achieved an high strength for replacement of zeolite powder for 28 days when compared to conventional concrete.
- The graph shows that there is no effect on strength of block prepared by zeolite sand and powder as a substitute.
- Hence this can be utilized without any problem in the buildings. The zeolite block can be used in the road pavements, Chimney of factory as well as at the faces of building.

- Apart from that construction industry contribute 70% of the total CO2 expelling. As while cement production and at the time of curing of the structure it will get evolved into atmosphere.
- It is very important to reduce CO2 emission. Hence it must be used in the construction.

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