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Optimum Blending Percentage of Powdered Zeolite with Cement & Concrete Absorbing Carbon dioxide

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Abstract: Concrete is the most used in day to day life in building and road material in world also nowadays pollution is also increased in surrounding so our project work is to try to solve this problem by preparing concrete which absorbs carbon dioxide. Zeolite is used to prepare this type of specimen.

Zeolite has properties to absorb natural gases and, in this project, we try to replace cement with zeolite with specific percentage of replacement.

Keywords: Concrete, Zeolite, Carbon dioxide absorption, Cement replacement, Pollution reduction

I. INTRODUCTION

With the increase in population, the demand for the construction increases. There by the production. Of cement-based construction materials increase which emit more carbon dioxide into the atmosphere. Also, with the increase in pollution the demand for the own vehicle increase. This leads to more vehicle emissions of carbon dioxide and other toxic gases into the atmosphere and pollute the atmosphere. To make road construction more eco-friendly, we need to reduce the amount of carbon dioxide (CO₂) emissions. One way to do this is by improving how concrete absorbs CO₂. Zeolite powder, a special material with lots of tiny holes and surface area, can help with this. By using zeolite in concrete replacement of cement to capture more amount of CO₂. This research looks at how well this works and how easy it is to use zeolite in concrete.

II. OBJECTIVE

- 1) To study out physical and chemical properties testing of powdered zeolite and OPC cement.
- 2) To find the optimum blending percentage of powdered zeolite with cement to get maximum strength
- 3) To study out Economy Comparison Between Conventional concrete and zeolite added concrete.

III. STUDY WORK

A. Properties Of Zeolite

1:- Environmental Applications

- 1) Co₂ Absorption: - Due to its porous nature, zeolite can capture and store carbon reducing greenhouse gas emissions in concrete and other building.
- 2) Water Filtration: - The high cation exchange capacity of zeolite allows it to remove heavy metals and ammonia from water, enhancing its effectiveness in environmental remediation efforts.
- 2:- Stability and Durability
- 3) Chemical Stability: - Zeolites are known for their high physical and chemical stability, attributed to strong covalent bonding within their framework. This stability allows them to maintain structural integrity under various conditions.
- 4) Hydrophobicity: - High-Silica zeolites tend to be more hydrophobic, making them suitable for application that require the absorption of bulky hydrophobic molecules such as hydrocarbons.

B. Properties Of Zeolite Mixing With A Concrete

Enhanced Durability: - Zeolite improves the long-term durability of concrete by reducing its permeability. This makes concrete less prone to water infiltration, which can lead to issues like corrosion of reinforcement steel and freeze-thaw damage. By enhancing the concrete's resistance to water and chemical penetration, zeolite helps extend the lifespan of structures.

IV. PREPRETION OF CONCRETE BLOCK

A. Procedure of Preparing block

- 1) Clean the molds: Ensure that the molds are free from any debris, dust, or remnants of previous casts. That prevents contamination and ensures a smooth finish on the blocks
- 2) ApplyReleaseAgent:Tofacilitateeasyremovaloftheconcreteblocksapplyamouldreleaseagentsuchas oil
- 3) Filling the molds: Pour Concrete into molds: carefully pour the mixed concrete into the mould ensuring that it fills all corners and edges. Use a trowel to pack the concrete down.
- 4) Compactingtheconcrete:CompactforDensity:-useamanualtappingtocompacttheconcretewithinthemoulds.This step helps remove air bubbles and ensures uniform density throughout the block. The concrete moulds for at least 24 hours at room temperature. To set the concrete to remove the moisture content Curing Process
- 5) Allow Curing: - Once filled and levelled, Allow the concrete Block to cure in water for at least 7&14 Days curing is essential for achieving strength and durability.

B. MixproportionfromM30Grandeconcrete

TABLE I
MIXPROPORTIONFROMM30GRANDECONCRETE

Ingredients	Cement	FineAggregate	CoarseAggregate	Water
Weightperm3	443kg	727kg	1097kg	186lit
Ratio	1 Kg	1.64Kg	2.47Kg	0.42liter
1Bag cement	50 Kg	82 Kg	123.5Kg	21 liter

C. 20%and30%replacementofcementwithzeolitematerialrequired.

.TABLEII
20%REPLACEMENTMATERIAL

Ingredients	Cement	Fine Aggregate	Coarse Aggregate	Zeolite powder	Water
Ratio	1Kg	1.64Kg	2.47Kg	-	0.42liter
1 Cube	1.870Kg	3.200Kg	5.100Kg	0.470Kg	1.5liter

TABLEIII
30%REPLACEMENTMATERIAL

Ingredients	Cement	Fine Aggregate	Coarse Aggregate	Zeolite powder	Water
Ratio	1 Kg	1.64Kg	2.47Kg	-	0.42liter
1Cube	1.630Kg	3.200Kg	5.100Kg	0.700Kg	1.5liter

V. TESTING

A. Compressive testing

TABLEIV
for 7 days curing of 20% replacement

Sr. No	Sample No	Dimension of the cube [mm]			Area of the cube [A] in mm ²	Failure Load [p] in kg	Failure Load [p1] in [N] [1kg = 9.81N]	Compressive Strength (δ) = P1/A in N/mm ²	Average %
		L	W	H					
1	1	150	150	150	22500	50000	490500	21.800	21.364
2	2	150	150	150	22500	48000	470880	20.928	
3	3	150	150	150	22500	49000	480690	21.364	

B. Carbonation Test.

.TABLEV
Resources required

Sr.No	Particulars	Specification	Quantity
1	Phenolphthalein solution	0.2% Concentration	300ml approx.
2	Measuring scale.	---	1 no
3	Physician's injection syringe or needle	5cc	1 no
4	Concrete cube sample	---	As per availability

.TABLEVI
Carbonation test results. 20% replacement cement

Sr. No	Sample No.	Dimension of concrete cube in [mm]			Area of concrete cube in [mm ²]	Total area of concrete cube out of which the carbonation is Done.	Carbonation is a percentage done in	Average %
		L	W	H				

1	1	150	150	150	22500	2900	12.89%	12.053
2	2	150	150	150	22500	2336	10.38%	
3	3	150	150	150	22500	2900	12.89%	

C. Figures



Fig.1:Carbonationtestmeasureinmm.

VI. COMPARISON

A.Compressive strength test comparison with M30 grade conventional concrete and 20% and 30% replacement cement withzeolite concrete.

.TABLEVII

Comparisonresults.

Curingdays	Kept in environmentdays	Percentage replacementof cement	Conventionalconcrete strength in N/mm2	Addedzeoliteconcrete in N/mm2
7 Days	14 Days	20%	20.190	21.364
7 Days	14 Days	30%	19.900	20.855
14 Days	28 Days	20%	25.500	27.148
14 Days	28 Days	30%	26.200	26.486

VII.CONCLUSIONS

Concreteabsorbscarbondioxide(CO2)throughanaturalprocesscalledascarbonation.

Thisprocesscanoccurthroughoutthelifeofconcretestructure.zeoliteaddedconcretehasmorestrengththanconventionalconcrete. When we add 20% zeolite, we come to know that strength is more as compare to 30% of replacement ofzeolite. Zeolite added concrete absorbs more CO2 as compare to conventional concrete. Cost of zeolite added concrete is 10% more than conventional concrete)".



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