

Strength and Durability Properties by Replacement of Natural Zeolite and Fly ash in Ordinary Portland Cement

Chalapati Harish, T.Naresh Kumar, V.Vishnuvardhan

Abstract: Natural zeolite and Flyash residue, a sort of hydrated Alumino-Silicate is used amply as ordinary pozzolanic material in particular areas of the world. In this calculation, the suitability of a secretly quarried zeolite and mineral admixture called fly ash is used for getting better mechanical and durability property of bond. The presentation of strong quality was better with a dissimilar degree of zeolite and fly ash was examined. The substitution on zeolite and fly ash with other proportions like 10% zeolite with ordinary Portland cement (OPC), 10% zeolite and 10% fly ash, 10% zeolite and 20% fly ash, 10% zeolite and 30% fly ash for M25 grade of concrete and done valuations with mechanical properties such as compressive strength, split tensile test, water permeability test, rapid chloride permeability test. By differentiating these effects between a run of the mill concrete and dissimilar degrees of Zeolite and Flyash. By comparing these results between normal concrete with different proportions of Zeolite and Flyash.

Keywords: Cement, fly ash, zeolite

I. INTRODUCTION

Concrete, typically Ordinary Portland cement concrete possibly will be a compound substance collected of a fine and coarse aggregate bond by the side of through a flowing cement (cement paste) to harden time mainly commonly a lime-based strengthen binder, like Portland cement, though naturally with another hydraulic cement, like a calcium-aluminate. It is well-known from different; non-cementitious types of concrete all required some type of aggregate along, as well as asphalt concrete through a hydrocarbon binder, to aid is normally used for the road surface.

Fly ash or flue residue, also called pulverized fuel residue in the UK may be energy-burning produce that's together of the particulates (fine element of burn fuel) to are determined out of coal-fired ignition chamber by the side of by resources of the channel gas. In the example to fly ash was produced since coal, as an instance, previously solid waste is incinerated in a specifically waste-to-energy ability in the way of providing electrical energy, the residue strength have a high level of pollutants than energy ash. In that container the powder formed is typically off the record as harmful waste. Most in abundance used the structure of natural pozzolanic material in a few regions of the sphere is natural zeolite, it's a form of hydrated alumina-silicate mineral then might be used as a more cementitious material. Zeolite tuff-

the lime mixture is widespread utilize in constructions while former period. Natural zeolite by the method of volcanic or volcano-sediment essential have a 3-dimensional outline structure and is portion as a hydrated alumina-silicate of alkali before alkaline earth cations. Crystals are considered as a honeycomb-like creation with mainly slight pore then channel, changeable in dimension from 3×10^4 to 4×10^4 micro meters. It's a similar entire specific surface interior and exterior area of 35 to 45 m^2 /gram is referred from Mumpton FA, editor, mineralogy and geology of natural zeolites. Newyork: Reprint of the mineralogical society of America's reviews in mineralogy; 1993. Zeolite is also known for its ability to lose stream by more than 30th of its dry weight.; moreover, component cations will be altered with no major conversion within the formation of crystals.

II. LITERATURE REVIEW

Miguel A.Climent et.al.(1999) this paper discusses regarding the potentiometric volumetric analysis process to produce usage of Gran's technique for end-point finding have been industrial to examine acid-soluble chloride in cement, mortar, and concrete, eliminate the filtration stepladder perform in normal laboratory situation ways. through this, the accurateness and accountability of the intended logical method has been check beside a normal method, like Volharda, by examining replacement sample of cement, mortars, and concretes by varied chloride contents and as well the result complete that the accurateness and task of the future technique is similar to that of a laboratory situation process like Volharda technique, for a Cl_2 attention vary as wide as 0.01 to 1.5% by some weight.

Nai-QianFeng et.al. (2005) exposed that readily available remain extra than one hundred zeolite mineral deposit create in a huge range of 21 provinces now an existence the practice of zeolite greater than earlier mainly in the industry of china. Natural zeolite is the relations of a frame. Structured alumina silicate hydrates. Zeolite is used in china future for both an ion-exchange efficacy then adsorption function. Natural zeolite is a unique mineral source for the creation and building materials, it acts as anti-bacteria agent, mineral admixture aimed at inhibition extension of material produced by alkali-aggregate reaction, blended material for cement developed.

Bulupradhan et.al.(2007) the author describes the conclusion of a complete tentative investigation everywhere the corrosion presentation of a variety of sorts of steel and cement be considered in several existing mixtures polluted complete admixed chloride.

Revised Manuscript Received on January 5, 2020

Chalapati Harish, PG Student, Dept. of Civil Engineering, AITS Rajampet, Kadapa, AP, India. Email: harishchalapati@gmail.com

T. Naresh Kumar, Assistant Professor, Dept. of Civil Engineering, AITS Rajampet, Kadapa, AP, India.

V. Vishnuvardhan, Assistant Professor, Dept. of Humanities and Sciences, AITS Rajampet. Kadapa, AP, India.

3 inconsistent sorts of steel, mainly cold twisted unshapely (CTD) bars and 2 kinds of thermo-mechanically treated (TMT) bars are original as steel reinforcement. 3 kinds of cement utilize in this investigation are ordinary portland cement (OPC), portlandpozzolana cement (PPC), and Portland slag cement (PSC). Decomposition current density, half-cell potential values, and as well the relative actual resistivity are intended by the side of with free and total chloride concentration and pH values of the concrete mixtures. From the revise, it had been completed that PSC achieves best in increase the corrosion start quantity while PPC performs best in extending the spread period amid the cement varieties. Similarly, Tempcore TMT steel performs bests each inside the start and spread quantity than the differing 2 kinds of steel.

Cenk Karakurt et.al. (2009) assembling of cement incorporates the blending of bond sand, totals, water and a few admixtures in fixed extents. Varieties of certain fixings will prompt the creation of light totals concrete. The interest in the use of light totals solid increments in the cutting edge world. Light totals solid comprises light-weighted totals, circulated air through material some unique admixtures. Supplanting of totals with fly fiery remains heater slag, pulverized materials, regular zeolite and silica smoulder, use of the materials will build the quality and sturdiness.

BabakAhmadi, et.al.(2010) was researched natural zeolite as cementitious material and it acts as a hydrated aluminosilicate as a bound pozzolanic material. By replacing the natural zeolite according to their properties to find out the strength of the concrete compared to ordinary concrete. In this commentary, the creator describes regarding the property of natural zeolite as well as by conduct some other minerals like silica fume and fly ash replace those materials according to the standard proportions. By replacing natural zeolite and silica fume on towards the concrete, and how lot strength it attains and it should acts as good pozzolanic reactivity. Then the author investigates replacing different extent the natural zeolite and silica fume and by conducts the laboratory tests. Such as compressive strength, electrical resistivity, water permeability and consequently on at which the zeolite at changed proportions it better the strength of concrete while comparing to usual concrete and by replacing natural zeolite with fly ash and better results are compared to normal concrete and also compare the durability and mechanical properties of both concrete.

Ali Doustiet.al.(2012) structures in the forceful conditions such marine situations. Chloride actuates the erosion. The alkalinity of cement gives the inactive condition around the steel bars. These uninvolved states can be broken by the nearness of chloride particles in cement. Rate of erosion increments with the nearness O_2 and H_2O . The development of consumption prompts the rusting of the steel bars which at last influences the life of the structure. Chloride dissemination increments erosion is one of the fundamental drivers of weakening of fortified solid with the expansion of temperature. For the most part India atmosphere conditions different from $20^{\circ}c$ to $50^{\circ}c$. So builds the extent of common zeolites and silica seethe as for the temperatures opposition the chloride disseminations which at last solid shows protection from the consumption.

Ramezianipouret.al.,(2013) by introducing the dense aggregates and by partially replacing the natural zeolite in low Portland cement with fresh and hardened cement and conducting the tests like self -consolidating cement J-ring, slump flow, T50time, GTM screen, electrical resistivity, chloride diffusion etc at which, the results should be compared between normal and replacement of natural zeolite.

FereshtehAlsadatSabet et.al.(2013)author describes and investigate that the mineral admixtures which introducing in this project those are natural zeolite, fly ash, silica fume is replacing with different proportions into cement and the by replacing/ combining the SCC and HPC of concrete with certain dosage and conducting the tests like compressive strength, electrical resistivity, water absorption, chloride permeability etc. Then compare the results between mineral admixtures with self -consolidating concrete and high-performance concrete.

VratislavTydlitát et.al.(2014) Cement gets its strength due to the hydration process. Cement containing the natural zeolite will help to acquire the early stage hydration zeolite is the normal volcanic (or) synthesize alumina silicate mineral through typical micro absorbent framework structure zeolite is ones of the other pozzolans which affects the hydration of cement that contributes the strength to the cement. Partial substitute cement through zeolite gives the optimistic results scheduled compressive strength furthermore resistance towards alkali, silica reaction. 5% substitute for cement with zeolite growth the durability of concrete. The early hydration of the cement can exist process with the thermogravimeter. The usage of usual zeolite will also increase the specific surfaces area which effects the strength of the cement.

Lisa E. Burris et.al.(2016)investigate the natural property ie; physical and substance property of a natural zeolite should be tested as well as investigate the effects of acid treatment and also study the effects of physical, chemical properties then analysis the hydration process of zeolite and cement (replacement proportion) correlation of those parts composition and then to determine or find out it should be an effective method which it is going increasing the strength of the concrete by using supplementary cementitious of a natural zeolite. This paper the natural zeolite can be tested son the chemicals (mentioned in conclusion) & hydrochloric acid, nitric etc and by conducting some tests like Icp, laser particle size analysis etc at which to compare the results between untreated acid test ie; normal concrete and replacement of natural zeolite. Then the results must be indicated the test is suited or not.

DzigitaNagrockiene et.al. (2016) partial substitute of cement with zeolite purpose modifies the structure of the concrete. This modification of structure will enhance the strength of the concrete. 10% alternative of cement with zeolite gives the 13.3% strength and regularly increases to 15% for the 28 days curing periods. alteration of cement will adjust the absorbent of the concrete will inferior water interest and higher stopped up porosity.

substitute with natural zeolite as well as improve the durability of concrete. **Yubin Jun et.al.(2017)** In the contemporary world, the cement and concrete industry is facing ecological challenges. Calcinations method for cement clinkers releases the tons of carbon dioxide interested in the setting which is the mainly efficiently global warming agent. The manufacturer OPC concrete also consumes a large quantity of freshwater, which is the rarest compound in the near potential in a number of parts of the world similar to the Middle East and northern parts of Africa. Pozzolans like fly ash, silica fume as well as some other equipment will cut the CO₂ production. This usage also enhances the strength and durability of the concrete.

III. MATERIALS

The materials used within the present examine are:

A. Cement:

Cement is used in concrete as a binding medium. The Cement used in the present is manufactured at Zuari Cement trade enterprise of 53 grade OPC (Ordinary Portland Cement) IS 12269-1987 Confirmation is used in this research. The assets of cement are specified in table-IV.

Physical properties of cement:

Dissimilar mixtures of cement used in construction are considered by their physical characteristics. Rare key parameters achieve the efficiency of cement. The physical belongings of good quality cement are based on:

Table-I: Properties of cement

S.No	Particulars	Results
1	Specific Gravity	3.12
2	Normal Consistency	29 percent
3	Initial Setting Time	33min
4	Final Setting Time	448min
5	Soundness Test	10mm
6	Fineness of cement	7.6%

B. Aggregates:

Aggregates characterize a key role in concrete. More or less threequarters of the quantity of usual concrete is taken by aggregate. It's inevitable that an ingredient occupying one of these large percentages of the mass has to make a contribution of essential properties to mutually the fresh and hardened state. IS code 2386 part I, part III, Part IV, part V study in this investigation process.

a. Fine aggregates: Fine Aggregate can be characteristic or produced sand, yet it must be of uniform reviewing. The molecule fineness than 150um strainer is considered as fines. To accomplish a harmony between deformability or smoothness and security. As per IS 383:1970, the fine aggregate of the total is being characterized into four similar zones that is zone-1, zone-2, zone-3, and zone-4. In this examination Zone-2 fine aggregate whole as utilized in both typical evaluation of concrete.

Table-II: Properties of the fine aggregates

S.no	Particulars	Results
1	Type	Fine Aggregate
2	Specific Gravity	2.64
3	Grading size	4.75mm
4	Water absorption	1.0%
5	Fineness modulus	2.87

b. Coarse Aggregates: Coarse aggregates will be generally classified into fourcategories. They are heavyweight, lightweight, normal weight and ultra-lightweight and the types of aggregates such as crushed, flaky, angular, rounded and elongated, in this investigation we are used flaky aggregates are used. Relying upon the size of the aggregate's strength is going to be depended and those classification and specifications are mentioned in this investigation process.

Table-III:Coarse aggregate's physical properties

S.no	Particulars	Results
1	Type	Crushed stone
2	Specific Gravity	2.72
3	Grading size	20mm
4	Water absorption	0.81%
5	Bulk density	1682kg/m ³

C. FLY ASH (FA):

Fly ash is being increasingly accepted these days as a cementitious material for cement concretes. In order to achieve the desired benefits from the use of this widely available and technically highly useful product from thermal power plants, a comprehensive understanding of different aspects of utility of FA here in this investigation the specification of fly ash is IS 3812-1981 we are using typeC type of fly ash in concrete is essential. The replace cement concretes (CCS) in structures provided FACs are suitably designed. The fly ash of Portland pozzolana cement of IS 1489 grade is employed in this investigation work. type C fly ash is classically resultingfrom coals sub-bituminous and contains mostly of calcium alumina-sulphate glass. Type C fly ash is furthermore mentioned to high calcium fly ash since it usually contains over 20 percent free lime. Type F fly ash is usually derived from the bituminous and anthracite coals and consists mainly of an alumina-silicate glass, among quartz, mullet, and magnetic iron-ore also present. Type aimed at low calcium fly ash has a lesser amount of than 10 percent free lime.



Fig. 1. Fly ash

Properties of fly ash:

Fly ash residue is a varied by-product substanceproduced in the burning technique of coal use in expert stations. It is a fine grey coloured residue having a sphere-shaped glassy particle that grows amid the chimney gases. As fly ash containpozzolanmaterials mechanism which creates complete lime to form cementitious materials. Consequently, Fly ash is used in concrete, mine, landfills as well as dams.

Strength and Durability Properties by Replacement of Natural Zeolite and Fly ash in Ordinary Portland Cement

Fly ash chemical composition:

The chemical composition of fly ash depends primary the sort of coal use and the procedure used for ignition of coal.

Table IV: Chemical composition of different coals fly ash.

Component (%)	Bituminous Coal	Sub Bituminous Coal	Lignite Coal
SiO ₂	20 to 60	40 to 60	15 to 45
Al ₂ O ₃	5 to 35	20 to 30	20 to 25
Fe ₂ O ₃	10 to 40	4 to 10	4 to 15
CaO	1 to 12	5 to 30	15 to 40
Loss of Ignition	0 to 15	0 to 3	0 to 5

Table V: The physical properties of fly ash are,

S.No	Particulars	Results
1	Fineness	34%
2	Specific gravity	2.75
3	Size and shape	10 to 100 microns
4	Colour	Dark grey

D. ZEOLITE:

Zeolites are normal porous volcanic tuffs that characterize the hydrated crystalline aluminosilicates minerals finished alkaline and earth-alkaline metals. Their chemical properties, a minor percentage of porosity, the capability of adsorption of the measurable draw high specific surface and low specific weight. few investigational research ensures zeolites brilliant mechanical possessions so as to signify this material bounded by the collection of building materials for structural elements. A new application of zeolite is as a chemical calculation in cement, as a full of lifespan mineral complement and binder constituents projected for silicate concrete as well as gypsum cement pozzolanic binder part and concretes maintained them. a mix of cement and zeolite is occupied for the manufacture of high-strength concrete finished larger solidity resistance than that of Portland cement. Primary impartial of this paper is to research the separation of the purpose of zeolites originates close to Probishtip in Macedonia. Properties of the being zeolites mightily depend upon the position of the site.

Properties of zeolite:

Zeolite is a mineral admixture, which is common new in some area of the planet and it is a sort of crystalline aluminosilicate as well as it must need a three-dimensional structure which is together by si-o tetrahedrons and Al-O tetrahedrons and it has pozzolanic property. Zeolite has a specific gravity 2.20, fineness 320 m²/kg through with an average particle size of 16.84 micro meters is mentioned from FereshtehAlsadatSabet, Nicolas Ali Libre, MohammadShekarchi. Mechanical and durability property of self-consolidating high-performance concrete with natural zeolite, fly ash and silica fume.

Table-VI: Chemical composition of zeolite

Test	Unit	Result	Test method
Moisture	%	0.98	Chemical & Instrumental Analysis, IBM : 2012
Silicon Dioxide - (SiO ₂)	%	63.87	
Aluminium Trioxide -(Al ₂ O ₃)	%	11.47	
Calcium Oxide - (CaO)	%	2.37	
Magnesium Oxide - (MgO)	%	1.00	
Sodium Oxide - (Na ₂ O)	%	6.81	
Potassium Oxide - (K ₂ O)	%	0.94	
P ^H (5% aq.suspension)	-	8.20	
Bulk Density	g/cc	1.05	
Water Absorption	ml/100g	30	

The above table is referred from M/S Simran minerals, lab I.d. no and date: SSAPL (CHI/14-15/N-1718) Dt.17.12.2014.



Fig. 2. Zeolite

E. Water:

Liquid i.e., water used for incorporation the cement have to be free as incomplete particles, & it has to be fit for consumption purpose. As for every study, we experimented with the purpose of a variety of researchers complete several tests on the water like pH, Hardness, Chloride Content tests etc.

IV. EXPERIMENTAL PROGRAM

A. Mix Proportions:

In the present investigation M₂₅ grade concrete mixes by replacing OPC with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of water is investigated.

B. The casting of Specimens:

The specimens are cast in the present study are cubes of size 150X150X150 mm, Cylinder measurement 150X300 mm, for 28,56,90 days. RCPT of dimension 100X50 mm for 56 days. water permeability of 200X120 mm are used for 56 days.

C. Mix Proportions:

Table-VII: Mix Proportions for M₂₅ grade concrete

Material	Quantity
Cement	394 Kg/m ³
Fine aggregate	743 Kg/m ³
Coarse aggregate	1115 Kg/m ³
Water	197 lit/m ³

V. EXPERIMENTAL RESULTS

A. Compressive strength of concrete cubes:

The compressive strength of M₂₅ grade concrete mix by replacing OPC with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of water is investigated. to get the optimum mix are shown in below table



Table-VIII: Compressive strength results for cubes

Mix designation	% Replacement			Compressive strength N/mm ²		
	Cement	Zeolite	Fly ash	28 days	60 days	90 days
M1	100	-	-	33.7	31.5	35.7
				28.1	32.9	30.1
				29.6	30.2	32.9
M2	90	10	-	33.4	38.8	43.0
				35.6	39.1	41.8
				38.6	37.8	40.9
M3	80	10	10	18.3	29.4	31.5
				19.6	28.7	32.5
				16.2	29.6	34.2
M4	70	10	20	23.9	32.6	29.5
				24.3	31.5	30.4
				23.1	30.2	31.6
M5	60	10	30	23.7	21.8	32.8
				23.9	25.8	30.2
				25.6	27.0	28.6

The results of compressive strength for these concrete mixture verified at 28 days, 60 days, 90 days and the graphical representation between compressive strength versus curing age of concrete is represented at below:

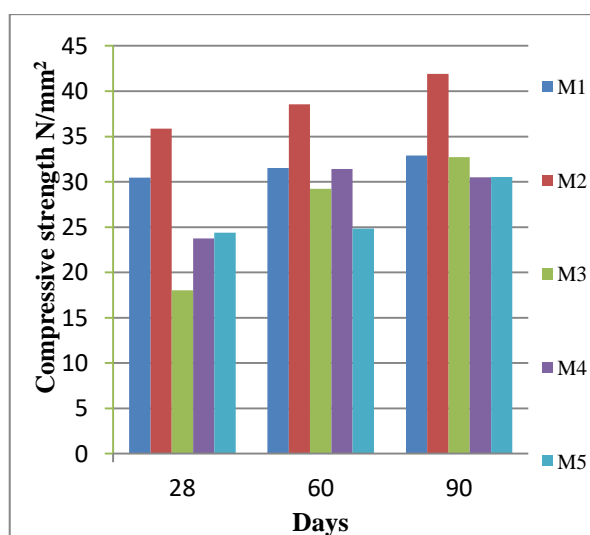


Fig. 3. Compressive strength for concrete cubes

The compressive strength of M₂₅ grade concrete mix by replace OPC with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of cement is investigate. The results of compressive strength for these concrete mixture tested at 28 days, 60 days, 90 days and the graphical illustration between compressive strength versus curing age of concrete is represented at above we got the approximate results i.e; only 10% of replacement of zeolite occurs the good results compare to other compositions.

B. Split Tensile strength of concrete cylinders:

The compressive strength of M₂₅ grade of concrete mix by replacing OPC with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight

of cement is investigate and the results are given in below table.

Table-IX: Split tensile strength results for Cylinders.

Mix designation	% Replacement			Split tensile strength N/mm ²		
	Cement	Zeolite	Fly ash	28 days	60 days	90 days
M1	100	-	-	3.0	2.2	2.8
				2.6	2.8	2.4
				2.4	3.2	2.6
M2	90	10	-	2.6	3.0	3.2
				2.8	2.8	2.6
				2.4	3.0	2.2
M3	80	10	10	2.4	3.0	2.0
				2.6	2.8	2.4
				2.4	3.0	2.6
M4	70	10	20	2.2	2.2	2.2
				2.4	2.6	2.4
				2.2	3.0	2.0
M5	60	10	30	1.8	2.2	2.4
				2.4	2.4	2.2
				2.2	2.0	2.4

The results of split tensile strength for these concrete mixture tested at 28 days, 60 days, 90 days and the graphical illustration between split tensile strength versus curing age of concrete is represent at below:

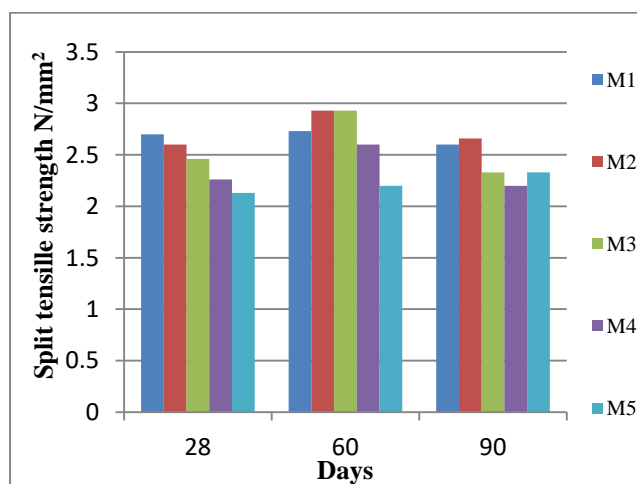


Fig. 4. Split tensile strength test

The split tensile strength of M₂₅ grade concrete mixes by replacing OPC with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of cement is investigated. The effects of split tensile strength for these concrete mixture tested at 28 days, 60 days, 90 days and the graphical illustration between split tensile strength versus curing age of concrete is represented at above we got the estimated effects at the age of specimen 56 days the estimated results are obtained very high at only 10% replacement composition of zeolite and 10% replacement composition of zeolite and fly ash and when it compares to age of the specimen 90 days the results are at only 10% zeolite and 30% fly ash when the results are obtained in the curing process.

C. Compressive strength Vs Split tensile strength:

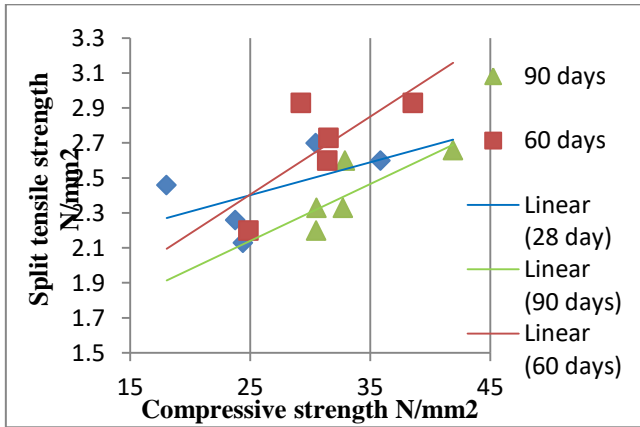


Fig. 5. Compressive strength Vs Split tensile strength

The compressive strength and split tensile strength of M₂₅ grade concrete mix by replace OPC with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of cement is investigate. The assessment results of split tensile strength, as well as compressive strength for these concrete mixtures experienced at 28 days, 66 days, 90 days and the graphical representation between comparison of split tensile strength and compressive strength, is represented at above we got the approximate results i.e; at the age of specimen 56 days the approximate results are obtained very high at only 10% replacement composition of zeolite and 10% replacement composition of zeolite and fly ash and when it compares to age of the specimen 90 days the results are at only 10% zeolite and 30% fly ash when the results are obtained in the curing process and the corresponding results are obtained in the above graph.

D. Rapid Chloride Permeability Test:

The Rapid Chloride Permeability test of M₂₅ grade of concrete by replace in ordinary Portland cement with zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of water is investigated.

Table-X: Specifications for RCPT Result

Charge (coulombs)	Chloride Permeability
>4000	High
2000 - 4000	Moderate
1000 - 2000	Low
100 - 1000	Very Low
<100	Negligible

Table-XI: Rapid Chloride Permeability test

Mix designation	% Replacement			RCPT 60 days
	Cement	Zeolite	Fly ash	
M1	100	-	-	1650
				1760
				1907
M2	90	10	-	2070
				2150
				2254
M3	80	10	10	2279
				2340
				2061
M4	70	10	20	2071
				2360
				2411
M5	60	10	30	1512
				1320
				1124

The results of rapid chloride penetration test for these concrete mixtures tested at 60 days and the graphical representation is represented at below:

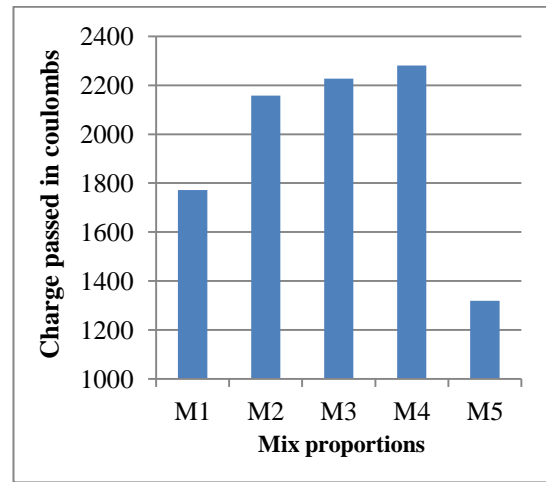


Fig. 6. RCPT test

E. Water permeability test:

The Water permeability test of M₂₅ grade of concrete by replaces in ordinary Portland cement with natural zeolite 0% in cement; 90% cement and 10% zeolite; 80% cement, 10% zeolite and 10% fly ash; 70% cement, 10% zeolite and 20% fly ash; 60% cement, 10% zeolite and 30% fly ash is replace by the weight of water is investigated.

Table-XII: Water permeability test

Mix designation	% Replacement			Depth of penetration (d in cm)	Coefficient of permeability (K in cm/sec)
	Cement	Zeolite	Fly ash		
M1	100	-	-	2.16	1.37×10 ⁻⁶
M2	90	10	-	2.2	1.10×10 ⁻⁶
M3	80	10	10	2.06	0.725×10 ⁻⁶
M4	70	10	20	2.14	1.71×10 ⁻⁶
M5	60	10	30	2.14	1.57×10 ⁻⁶

The results of water permeability test for these concrete mixtures tested at 60 days and the graphical representation is represented as below.

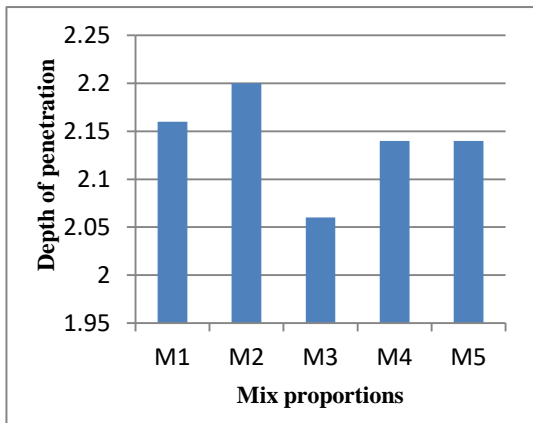


Fig.7. Water permeability test

VI. CONCLUSION

▪ Natural zeolite and fly ash are the supplementary cementitious pozzolanic materials in some regions of the globe is natural zeolite, it's a sort of frame-structured hydrated aluminosilicate mineral as well as maybe use as a supplementary cementitious substance and the Fly ash residue also called crushed fuel ash in the UK, might be a energy combustion produce that's collected of the particulates that are driven out of coal-fired boilers next to with the flue gases.

▪ Based on these replacement materials conducting an experiment on zeolite and fly ash replacement with a different ratios of 10% zeolite in ordinary Portland cement (OPC), 10% zeolite and 10% fly ash, 10% zeolite and 20% fly ash, 10% zeolite and 30% fly ash in M25 grade of concrete within the near study the mechanical property like compressive strength, split tensile test, water permeability test, rapid chloride test, Non-destructive tests i.e.; rebound hammer conduct and the exact results are mentioned.

Future scope: in this investigation process, the natural zeolite and fly ash with a necessary composition are applied, based on this project we can use another type of cement and concretes such as high strength concrete with different proportions and find out the strength of the concrete is applicable for the next generation.

REFERENCES

1. Miguel A. Climent, Estanislao Viqueira, guillem de Vera, "Analysis of acid-soluble chloride in cement, mortar and concrete by potentiometric titration without filtration steps" cement & concrete research 29(1999):pp.893-898.
2. Nai-Qian Feng, Gai-Fei Peng, "Applications of natural zeolite to construction and building materials in China", Construction and Building Materials 19 (2005):pp. 579-584.
3. BuluPradhan and B. Bhattacharjee, "Role of Steel and Cement Type on Chloride-Induced Corrosion in Concrete", ACI materials / journals Dec2007 PP:612-618.
4. Cenkkarakurt ,HaldunKurama , IlkerBekirTopcu , "Utilization of natural zeolite in aerated concrete production",Cement& Concrete composite 32 (2010) :pp.1-8.
5. BabakAhmadi, Mohammad shekarchi,"utilize of natural zeolite as a supplementary cementitious material", cement & concrete composites 32(2010):pp.134-141
6. Ali Dousti, Reza Rashetnia,Babak Ahmadi,Mohammad shekarchi, "Influence ofexposure Temperature on chloride diffusion in concrete incorporating silica fume or natural zeolite", construction and building materials 49(2013):pp.393-399.
7. Ali Akbar Ramezaniapour, Ali Kazemian, MortezaSarvari, BabakAhmadi, "Use of Natural Zeolite to Produce Self-Consolidating Concrete through Low Portland Cement Content and High Durability"

DOI: 10.1061/(ASCE)MT.1943-5533.0000621.2013 American Society of Civil Engineers.

8. FereshtehAlsadatSabet, Nicolas Ali Libre, Mohammad Shekarchi, "Mechanical and durability properties of self-consolidating high presentation concrete incorporating natural zeolite, silica fume and fly ash", construction and building materials 44(2013):pp.175-184.
9. VratislavTydlit, Jan Zakoutsky, Robert Cerny, "Early-stage hydration heat development in blended cement containing natural zeolite studied through isothermal calorimetry", ThermochimicaActa 582(2014):pp.53-58.
10. Lisa E. Burris*, Maria C.G. Juenger, "Milling as a pretreatment method used for increasing the reactivity of natural zeolites for use as supplementary cementitious materials", Cement and Concrete Composites 65 (2016):pp.163-170.
11. DzigitaNagrockiene, GiedriusGirskas, "Research into the properties of concrete modified through natural zeolite addition", Construction and Building Materials 113 (2016): pp. 964-969.
12. Yubin Jun, Seyoon Yoon and Jae Eun Oh, " I A Comparison Study for Chloride-Binding Capacity among Alkali-Activated Fly Ash and Slag in the Use of seawater", Applied sciences 7(2017):pp-971;DOI:10.3390/app7100971.
13. Eva Vejmelkova, Dana Konakova, Martin Keppert, JaromirZumar, Robert Cerny, "Engineering property of concrete containing natural zeolite as supplementary cementitious material: Strength, toughness, durability, and hygrothermal performance", cement & concrete composites 55(2015):pp.259-267.
14. T.Subramani, J.Karthickrajan "Experimental Study On Absorption Of CO2 By M30 Concrete As A Partial alternative Of Cement By 25% Of Zeolite" Volume 5, Issue 5, May 2016 ISSN 2319 – 4847
15. Ali Akbar Ramezaniapour, RahimehMousavi, MoosaKalhori, JafarSobhani, MeysamNajimi, "Micro and macro-level property of natural zeolite contained concrete", Construction and Building Materials 101 (2015):pp.347-358.
16. Byung-Wan Jo, Ji-Sun Choi, Kwang-Won Yoon, Jung-Hoon Park, "Material sort of zeolite cement mortar", construction and building materials 36(2 012):pp.1059-1065.
17. Yilmazkocak, EdaTasci, Unal kaya, "The effect of using natural zeolite on the properties with hydration characteristics of blended cement", construction and buildings materials 47(2013):pp.720-727.
18. E. Kucukyildirim, B. Uzal, "Characteristics of calcined natural zeolites used for use in high-performance pozzolan blended cement", construction and building materials 73(2014):pp.229-234.

AUTHORS PROFILE



Chalapati Harish, pg student, structural engineering in department of civil engineering, AITS Rajampet, Andhra Pradesh.



T Naresh Kumar, holds PhD and published 42 research publications and have professional memberships from MIE, MISTE, MISET, MICE(I), C.Eng(I), MIAEng.



V. Vishnuvardhan, i have completed M.Sc, M.phil and Ph.d in Environmental Science at sri venkateswara iniversity in Tirupathi, Andhra Pradesh . I have qualified VGE NET and SET in Environmental science.