STRENGTH AND PERMEABILITY PROPERTIES OF CONCRETE USING FLY ASH (FA), RISE HUSK ASH (RHA) AND EGG SHELL POWDER (ESP)

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***Abstract*- In this study centers around the growth of strength and permeability of concrete by partial replacement of cement with joint ratio of fly ash, rise husk ash with synthetic egg shell powder (ESP). Two categories of fly ash and rise husk ash with four distinct content of 5%, 10%, 15%, 20%, 30% in terms of weight was perform for the substitution of cement and addition of a persistent 5%egg shell powder in every Substitution. Concrete is being widely use for construction of most of building, bridges etc. Hence it is the most important part to the infrastructure development of a nation. To meet out this rapid infrastructure development a high quantity of concrete is required and cement is the main ingredient of concrete and demand for exceed the supply make the construction activity costlier. To minimize the use of cement and ultimately reduce the construction cost use effective waste material like fly ash, rise husk ash and egg shell powder with cement replacement.**

Key words: Fly ash, Rise husk Ash, Egg shell powder, Green concrete, Sand replacement.

1. INTRODUCTION

Natural resources are of two types the renewable and the non renewable which can be recycled again and again which are utilize for our benefits. But non renewable resources are those which once removed and utilized are lost forever. The major problem facing by mankind today is about the utilization of natural resources in order to meet human need and economic growth without exhausting the resources and endangering the environmental integral on which life economic prosperity and our security depend. The world wide utilization of regular sand is high because of the broad utilization of cement. Specifically, the interest for regular sand is high in creating nation inferable from quick infrastructural development, buildings and different structures in since cement assumes the critical part a substantial quantum of its being used.

Fly ash is consisting of the non combustible mineral portion of coal consumed in a coal fueled power plant. Those are collected from the combustion air steam brick bhatti. Rise husk ash globally, on an average 30% of the rise husk ash paddy is husk, giving an annual total production of 130 million tones. The treatment of rise husk as a resource for energy production is a departure for the perception that husk present disposal problems. In last recent years, special attention has been studied to industrial sector that are sources of pollution of the environment the industry produces large volumes of solid wastes.

A huge problem of pollution is origanated. In addition, it can attract warms and rats due the organic protein matrix, which creates a problem of public health. The studies have been already made in this area by using egg shell powder is ceramic material primarily composed of clays, carbonates etc.

1.1 Advantages of Fly Ash

a. The use of fly ash in ordinary Portland cement improves concrete performance in both the fresh and hardened state.
b. Fly ash use in concrete improves the workability of concrete,
c. Fly ash also increases the strength and durability of hardened concrete.
d. When fly ash is added to concrete, the amount of Ordinary Portland cement may be reduced**.**
e. The replacement of cement by fly ash reduces the water demand for a given slum

1.2 Advantages of Rise Husk Ash

The use of RHA in concrete has been associated with the following essential assets:

a. Increase compressive and flexural strength
b. Increase resistance to chemical attack
c. Reduce permeability

d. Increase durability

e. Use of rise husk ash reduce shrinkage due to particle packing, making concrete denser

1.3 Advantages of Egg Shell Powder

a. Egg shell powder reduce in alkali-silica and sulfate expansions.

b. Meets the most stringent environmental regulations nationwide.

c. Egg shell powder ideal for painting in occupied spaces.

d. It has excellent durability and also washable finish.

e. This waste material Resist mold and mildew on the paint film.

1.4 Outline of Project

Proposed project Work is carried out in following stages

- To Study the properties of constituent materials.
- To carry out the concrete mix design for decided grade of concrete.
- Check the feasibility of replacement of cement by fly ash(FA) ,rise husk ash(RHA) and egg shell powder(ESP)
- Vary the proportion of fly ash and rise husk ash with constant proportion of ESP and decide the optimum percentage of FA, RHA AND ESP on the basis of Compression, Split Tensile and Flexural test.

2. MATERILS AND TESTING

Following materials are used in present study

- Cement
- Sand
- Aggregate
- Water
- Fly Ash (FA)
- Rise Husk Ash (RHA)
- Egg Shell Powder (ESP)

2.1 Cement

Hydraulic cement made by finely pulverizing the clinker produced by calcining to incipient fusion a mixture of argillaceous and calcareous materials Portland cement is the fine gray powder that is the active ingredient in concrete. The raw materials used for the manufacture of cement consist mainly of lime, silica, alumina and iron oxide. These oxides interact with one another in the kiln at high temperature to form more complex compounds. The relative proportions of these oxide compositions are responsible for influencing the various properties of cement; in addition to rate of cooling and fineness of grinding. The following table shows the approximate oxide composition limits of ordinary Portland cement.

2.2 Natural Sand

River sand is a widely used construction material all over the world, especially in the production of concrete, cement-sand mortar and concrete blocks.

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. The composition of sand varies, depending on the local rock sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide, or $SiO2$), usually in the form of quartz The second most common type of sand is calcium carbonate, for example aragonite, which has mostly been created, over the past half billion years, by various forms of life, like coral and shellfish. It is, for example, the primary form of sand apparent in areas where reefs have dominated the ecosystem for millions of years like the Caribbean.

2.3 Aggregates

In addition to cement, water and aggregates are the other primary constituents of concrete mixtures. Aggregate is a rocklike material of various sizes and shapes, used in the manufacture of Portland cement concrete, bituminous (asphalt) concrete plaster, grout, filter beds, and so on. The ASTM standards (C125 and D8) define aggregate as a granular material such as sand, gravel, crushed stone, or iron- blast furnace slag used with a cementing medium to form mortar or concrete, or alone as in base course or railroad ballast. Crushed stone, sand, and gravel are the three main types of aggregate. Besides, aggregates can be divided into several types based on the type of rock from which they are derived, the method of manufacture, the size, or the density.

Aggregates are one of the imperative constituents of concrete and they constitute about 75 to 80% of total volume of concrete. They help in decrease of shrinkage and influence economy as it were. Coarse aggregate is the most grounded and scarcest penetrable part of concrete. It is all around that pounded stone aggregate lead to higher qualities than adjusted ones. In the present examination, provincially accessible smashed rock of size 20 and 1.5mm in the degree of 67% and 33% exclusively by volume were used.

2.4 Water

Potable water was used in this study. Water is a crucial component of concrete as it is viably included in chemical responses with cement, particularly hydration. In the present examination consumable water is used according to IS 456: 2000 was used for preparation of cement, the water concrete proportion chooses the quality of cement. It is an adequately taking an interest constituent material in the synthetic response with bond. The workability of the concrete is controlled by various components, for instance, the beginning measure of water, the reactivity of cement.

2.5 Fly Ash (FA)

Fly is produced by steam generating and coal fired power plant. To fulfil the requirement of this investigation fly ash was obtained from thermal power plant, like brick bhatti pulgaon. From the resources fly ash of size 75 μm was gathered. It is desirable to all content of fly ash is substitution of IS 3812-1981 ASTMC618 are limited for fly ash for employment in concrete.

2.6 Rise Husk Ash (RHA)

Rice husk residue was gathered from a rice mill, tumser, India as shown in fig 2.1. At the outset, rice husk will transform into ash by means of open burning technique at a temperature, within a range of 350^{0C} to 450^{0C} and un- burnt carbon quantity of this material was found in the resulting ash at a temperature below 600^{0C}.Substantial research has been carried out on the use of amorphous silica in the manufactured of concrete. There are two area for which RHA is used, in the manufacture of low cost building blocks and in the production of high quality cement.

Fig. 2.1 Rise Husk Ash

2.7 Egg Shell Powder (ESP)

Egg shell has a cellulosic structure and it also contains amino acids, thus, it is expected to be a good bio-sorbent and it was reported that large amounts of egg shells are produced in some countries, as waste products and disposed in landfills annually. Egg shell and egg shell powder as shown in fig. 2.2. This waste material consists of several mutually growing layers of CaCO3, the innermost layer-maxillary 3 layer grows on the outermost egg membrane and generate the base on which palisade layer constitutes the thickest part of the egg shell. The top layer of egg shell is a vertical layer covered by the organic cuticle. The eggshell primarily contains protein, calcium and lime. In many other countries, it is the accepted practice for eggshell to be dried and use as a source of calcium in animal feeds. The quality of lime in eggshell waste is influenced greatly by the extent of exposure to sunlight, raw water and harsh weather conditions.

Fig 2.2 Egg Shell and Egg Shell Powder

2.8 TESTING ON CEMENT

2.8.1 Slandered Consistency of Cement Slandered Of IS 4031 (part 4) 1988

Definition

The standard consistency of a cement paste is defined as that consistency which will permit the vicat plunger to penetrate to a point 5 to 7mm from the bottom of the vicat mould.

Apparatus

- Vicat apparatus conforming to is: 5513-1976.
- Weighing balance accurate up to 0.1 gm
- Non-porous plate
- Tray
- Stopwatch
- Gauging trowel conforming to IS: 10086-1982.

Material: cement sample and water

Prior Concepts: Type of cement, chemical composition of cement, physical properties of cement.

Theory: The Standard consistency of a cement paste is defined as that consistency which will permit a vicat plunger having 10 mm dia. & 50 mm length to penetrate to a depth of 33-35 mm from top of the mould. The apparatus is called vicat apparatus. This apparatus used to find out the percentage of water required to produce a cement paste of standard consistency. The consistency of cement paste is sometime called normal consistency.

Procedure:

1) Take about 400 gm. of cement and prepare a paste with a weighed quantity of water (say 25% by wt. of cement) for first trial.

2) The paste must be prepared in a standard manner & filled in to the vicat mould within 3-5 minutes.

3) After completely filling the mould, shake the mould to expel air. A standard plunger, 10 mm dia. & 50 mm long is attached & bought down to touch the surface of the paste in the test block & quickly released allowing it to sink into the paste by its own weight.

4) Take the reading by noting the depth of penetration of the plunger in mm.

5) Conduct second trial only change is, take water 25% of wt. of cement & find out the depth of penetration of plunger. Similarly conduct trial with higher & higher w/c ratios till such time the plunger penetrates for a depth of 33-35 mm from the top.

Fig. 2.3: Vicat's Apparatus

Observation:

Type & brand of cement = Ordinary Portland Cement

Grade of cement = 43

Quantity of cement sample taken for test = 400gm

Table 3.4 Standard Consistency of Cement

Result: The standard consistency of cement sample is found to be 34%

Precaution: Care shall be taken to maintain the specified temperature, humidity and the time of mixing so as to avoid setting of cement paste.

2.8.2 Soundness Test on Cement

Le-chatelier apparatus is used for finding soundness of cement. It consists of a small spilt cylinder of spring brass or other suitable material. It is 30mm in diameter and 30mm high. On either side of the split are attached two indicator arms 165mm long with pointed ends. Cement is gauged with 0.78 times the water required for standard consistency, in a standard manner and filled into the mould kept on a glass plate. The mould is covered on the top with another glass plate. The whole assembly is immersed in water at a temperature of 270c– 320c and kept there for 24 hours. Measure the distance between the indicator points. Submerge the mould again in water. Heat the water and bring to boiling point in about 25-30 minutes and keep it boiling for 3 hours. Remove the mould from the water, allow it to cool and measure the distance between the indicator points. The difference between these two measurements represents the expansion of cement. This must not exceed 10mm for ordinary, rapid hardening and low heat Portland cement. If in this case the expansion is more than 10mm as tested above, the cement is said to be unsound.

Fig. 3.4 Soundness Test of Cement by le-chatelier apparatus

2.8.3 Initial Setting Time

It is the interval of time between which water is added to the cement to the instant when Vicat needle fails to penetrate the paste 5mm from its bottom.

Procedure

- For calculating the initial setting time 500 gm. of cement with 0.85 times the water required to produce cement paste of standard consistency (0.85 P) is taken.

- The paste is filled into the Vicat mould in specified manner within 3-5 minutes and stop watch is started at the moment water added to the cement.
- The needle is lowered gently to bring it in contact with the surface of the test block and quickly released, allowing it to penetrate into the test block.
- The interval between the time when water is added to the cement and the time at which the needle penetrates the test block to a depth equal to 33-35 mm from the top is taken as initial setting time.
- The initial setting time is found to be 155 minutes.

2.8.4 Final setting time

It is the interval of time between which the water is added to the cement to the instant when the Vicat needle fails to make annular impression at the surface of the test block.

3. MIX DESIGN

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible**.**

3.1 Indian Standard Recommended Method Is 10262 -82

3.1.1. Requirements

a) Specified minimum strength = 30 N/Sq mm

b) Durability requirements

i) Exposure Moderate

ii) Minimum Cement Content = 320 Kgs/cum

c) Cement

(Refer Table No. 5 of IS:456-2000)

i) Make Chetak (ACC)

ii) Type OPC

iii) Grade 43

d) Workability

i) compacting factor = 0.7

4.1.2 Test Data For Materials Supplied

a) Cement

i) Specific gravity = 3.15

ii) Avg. comp. strength 7 days = 46.5 more than 33.0 OK

28 days = 55.0 more than 43.0 OK

B) Coarse Aggregate

i) 20mm Graded

Type Crushed stone aggregate

Specific gravity = 2.87

Water absorption = 0.96

Free (surface) moisture = 0

C) Sand

i) Type Natural (Ghaggar)

Specific gravity = 2.62

Water absorption = 1.4

Free (surface) moisture = 0

4.1.3 Target Mean Strength (TMS)

a) Statistical constant K = 1.65

b) Standard deviation S = 4.6

Thus, TMS = 39.90 N/Sqmm

4.1.4 Selection of W/C Ratio

a) As required for TMS = 0.43

b) As required for 'Moderate' Exposure = 0.55

Assume W/c ratio of 0.45

4.1.5 Determination of Water & Sand Content

For W/C = 0.45

C.F. = 0.8

Max. Agg. Size of 20 mm

a) Water content = 172.0 Kg/cum

b) Sand as percentage of total aggregate by absolute volume = 35 %

Thus,

Net water content = 172.00 Kg/cum

Net sand percentage = 33 %

Table 3.1 Adjustment in mix design

Sr. No.	Change in condition	Adjustment (in %) required in			
		Water content		Sand content	
		Rate	W	Rate	P
i)	Sand conforming to Zone-II	0	0	0	0
ii)	Decrease in CF by 0.1 (CF reqd = 0.7)	-3	-3	0	0
iii)	Each 0.05 decrease in W/C ratio Required W/c = 0.5 Decrease=0.6-0.5=0.1	0	0	-1	-2
iv)	For rounded agg	NA		NA	
TOTAL ADJUSTMENTS			-3		-2

The final mix proportions of M-30 grade of concrete become

Table 3.2 Mix Design

Cement	FA	CA	Water
400	678.00 Kg	1212.0 Kg	172.0 lit
1	1.69	3.03	0.43

4.2 CASTING DETAILS

Ordinary Portland cement of Grade 43 is partly substituted with pozzolans at the dosage of 0–30% by weight of cementious materials. A mixture of various weight parts of Fly Ash, Rise husk ash and additive of Egg shell powder of 5% in each substitution along with the control mix were Structured with a water to binder W/(C + FA + RHA + ESP) ratio of 0.5 for a design cube compressive strength of 30 MPa. These mixes were represented as 0 for control and A1–A5 for ESP concretes.

The coarse aggregate used in this investigation have a maximum size of 20 mm with grading confirming to IS-383-1970. The natural river sand passing through 4.75mm sieves is used throughout the process. Ordinary clean potable tap water free from suspended particles and chemical substances was used for mixing and curing of concrete throughout the experiment.

The concrete mix design was done as per guidelines of IS 10262: 2009 with a grade of M 30 concrete. The simple hand mixing method was apply for mixing of concrete. First coarse and fine aggregates are mixed alternately, followed by cement. The mixing was done for two minutes for all the ingredients to mix properly.

Compaction of the entire specimen was done by using tamping steel rod and shake table vibrator. The top surface of concrete is levelled, finished smooth by using a trowel as shown in fig. 4.2. The specimen detail and date of concreting was specified on top surface of concrete block to identify it properly. After 24 hours, all the concrete specimens were removed from the mould and placed in the curing tank for 7, 14 and 28 days curing period.

Fig. 3.2 casting of concrete cube

4. METHODOLOGY

In this experimental study attempt has been made to find out the strength and permeability properties of concrete produced by replacing the cement with fly ash, rise husk ash and egg shell powder in various percentages ranging from 5% to 20% and 30% in increments of 5% [0%, 5%, 10%, 15%, 20%]and 30%. Ordinary Portland cement (OPC) 43 grade, locally available sand from wardha river and coarse aggregates were used in this experimental study. The sand was used Zone II had the specific gravity 2.62. The specific gravity of the coarse aggregate was 2.87. The coarse aggregate used were of 12mm and down size. The 75 micron passing fraction was used for the experimentation. Mix design carried out for M30 as per IS 10262:2009 yielded a mix proportion of 1: 1.69: 3.03 with water cement ratio of 0.43. Specimens were prepared according to the mix proportion and by replacing cement with FA and RHA with constant proportion (5%) of egg shell powder in different proportion and use of sand. An increasing trend in compressive strength and permeability was observed with increasing replacement of cement. To find out compressive strength, split tensile strength, flexural strength and permeability of specimens of dimensions 150x150x150mm, 150x300mm and 150x150x700mm were cast and tested as per IS 516:1959. Details of mix content with constant coarse aggregate and w/c ratio as shown in Table.

Table: 4.1 Mix proposition Symbol

Mix designation	Symbol	Cement %	Replacement		Additive
			FA	RHA	ESP
A0	_	100	_	_	_
A1	2.5FA2.5RHA5ESP	95	2.5	2.5	5
A2	5FA5RHA5ESP	90	5	5	5
A3	10FA10RHA5ESP	80	10	10	5
A4	15FA15RHA5ESP	70	15	15	5
A5	20FA20RHA5ESP	40	20	20	5

Table: 4.2 Mix proportions of ESP concretes

Mix designation	Cement %Kg/m3	FA %Kg/m3	RHA %Kg/m3	ESP %Kg/m3	% of replacement
A0	400	_	_	_	0
A1	380	10	10	20	5
A2	360	20	20	20	10
A3	280	60	60	20	15
A4	240	80	80	20	20
A5	160	120	120	20	30

4.1 COMPRESSIVE STRENGTH TEST

Out of many test applied to the concrete, this is the utmost important which gives an idea about all the characteristics of concrete. By this single test one judge that whether Concreting has been done properly or not. For cube test two types of specimens either cubes of 15 cm X 15 cm X 15 cm or 10cm X 10 cm x 10 cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15 cm x 15cm x 15 cm are commonly used. This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of these specimens should be made even and smooth...These specimens are tested by compression testing machine after 7, 14 and 28 days curing.

Compressive strength test results are primarily used to determine that the concrete mixture as delivered meets the requirements of the specified strength, fck in the jobs specification. The test was conducted on the cube specimen of size 150×150×150mm.

Compressive Strength = Failure Load / Cross Sectional Area of Cube

Fig. 4.1 Compressive Test on Concrete

Table: 4.3 Mix Proportion And Compressive Strength Of Egg Shell Powder (ESP) Concrete

Mix designation	Symbol	Compresive srength (Mpa)		
		7 Days	14 Days	28 Days
A0	OPC	24.23	27.68	31.51
A1	2.5FA2.5RHA5ESP	26.7	32.6	39.2
A2	5FA5RHA5ESP	26.96	34.74	40.12
A3	10FA10RHA5ESP	28.12	34.96	40.98
A4	15FA15RHA5ESP	30.1	35.24	45.2
A5	20FA20RHA5ESP	21.26	22.23	37.24
A6	30FA30RHA5ESP	14.89	18.24	28.67

4.2 SPLIT TENSILE STRENGTH

This test method consists of applying a diametral compressive force along the length of a cylindrical concrete specimen at a rate that is within a prescribed range until failure occurs. This loading induces tensile stresses on the plane containing the applied load and relatively high compressive stresses in the area immediately around the applied load .Tensile failure occurs rather than compressive failure because the areas of load application are in a state of triaxial compression, thereby allowing them to withstand much higher compressive stresses than would be indicated by a uniaxial compressive strength test result.

- Splitting tensile strength is generally greater than direct tensile strength and lower than flexural strength (modulus of rupture).
- Splitting tensile strength is used in the design of structural lightweight concrete members to evaluate the shear resistance provided by concrete and to determine the development length of reinforcement.

Table. 4.4 Split Tensile Strength Result

Mix designation	Symbol	Tensile srength	
		7 Days	28 Days
A0	_	3.8	4.23
A1	2.5FA2.5RHA5ESP	4.18	4.62
A2	5FA5RHA5ESP	4.42	4.78
A3	10FA10RHA5ESP	4.8	5.11
A4	15FA15RHA5ESP	5.15	5.61

5.3 FLEXURAL STRENGTH

Flexural strength is one measure of the tensile strength of concrete. It is a measure of an unreinforced concrete beam or slab to resist failure in bending. It is measured by loading 6 x 6-inch (150 x 150-mm) concrete beams with a span length at least three times the depth. The flexural strength is expressed as Modulus of Rupture (MR) in psi (MPa) and is determined by standard test methods ASTM C 78 (third-point loading) or ASTM C 293 (center-point loading). Flexural MR is about 10 to 20 percent of compressive strength depending on the type, size and volume of coarse aggregate used. However, the best correlation for specific materials is obtained by laboratory tests for given materials and mix design. The MR deter- mined by third-point loading is lower than the MR determined by center-point loading, sometimes by as much as 15%.

The test specimen shall have approximate dimensions of 6 in. x 6 in. x 20 in. (152 mm x 152 mm x 508 mm). The test specimen shall be kept wet until the time of the test.

1. Prepare the test specimen by filling the concrete into the mould in 3 layers of approximately equal thickness. Tamp each layer 35 times using the tamping bar as specified above. Tamping should be distributed uniformly over the entire cross section of the beam mould and throughout the depth of each layer.
2. Clean the bearing surfaces of the supporting and loading rollers, and remove any loose sand or other material from the surfaces of the specimen where they are to make contact with the rollers.
3. Circular rollers manufactured out of steel having cross section with diameter 38 mm will be used for providing support and loading points to the specimens. The length of the rollers shall be at least 10 mm more than the width of the test specimen. A total of four rollers shall be used, three out of which shall be capable of rotating along their own axes. The distance between the outer rollers (i.e. span) shall be **3d** and the distance between the inner rollers shall be **d**. The inner rollers shall be equally spaced between the outer rollers, such that the entire system is systematic.
4. The specimen stored in water shall be tested immediately on removal from water; whilst they are still wet. The test specimen shall be placed in the machine correctly centered with the longitudinal axis of the specimen at right angles to the rollers. For moulded specimens, the mould filling direction shall be normal to the direction of loading.
5. The load shall be applied at a rate of loading of 400 kg/min for the 15.0 cm specimens and at a rate of 180 kg/min for the 10.0 cm specimens.

The Flexural Strength or modulus of rupture (**f_b**) is given by

$$\mathbf{f_b = pl/bd^2}$$ (when **a**> 20.0cm for 15.0cm specimen or > 13.0cm for 10cm specimen)

or

$$\mathbf{f_b = 3pa/bd^2}$$ (when **a**< 20.0cm but > 17.0 for 15.0cm specimen or < 13.3 cm but > 11.0cm for 10.0cm specimen.)

Where,

a = the distance between the line of fracture and the nearer support, measured on the center line of the tensile side of the specimen

b = width of specimen (cm)

d = failure point depth (cm)

l = supported length (cm)

p = max. Load (kg)

Table. 4.5 Flexural Strength Result

Mix designation	Symbol	Flexural srength	
		7 Days	28 Days
A0	_	4.7	6.22
A1	2.5FA2.5RHA5ESP	4.77	6.31
A2	5FA5RHA5ESP	5.27	6.45
A3	10FA10RHA5ESP	5.36	6.68
A4	15FA15RHA5ESP	5.41	6.92
A5	20FA20RHA5ESP	3.80	5.96

4.4 WATER PERMEABILITY TEST

The water Permeability test determines the resistance of concrete against water under hydrostatic pressure and cube specimens was calculated in terms of IS3085 -1997. In this test connect the water outlet tube to the Luer socket on the top of the hypodermic and ensure that the fine plastic inner tube is of sufficient length to reach the bottom of the test cavity. After filling the syringe with distilled water connect it to the water inlet on top of the instrument. The water is then forced into the cavity and the air displaced out through the outer tube through the overflow tube which is 4 'inches (100 mm) above the surface of the concrete. The cavity is filled when water starts to flow out the overflow tube. The instrument flow sensor and timer then automatically measures the time taken for the water meniscus to travel a distance of 50 mm and this time in seconds is displayed. The test cube specimen was kept dried for two days after 28 days moisture curing. The investigation concrete models are preserved by means of molten wax compound in the cells to block any outflow along the side walls. The top surface of the specimens was covered with a piece of paper. After it is sufficiently sealed, it should safely bolt the bottom plate and funnel in placed. Moreover, the pressure must be controlled by rotating the handle of pressure in clockwise direction and the opening the release valve. Now the quantity of water passing throgh the cube every one hour period must be collected until the identical velocity of flow is attained. The coefficient of permeability is determined by means of the following formula

$$K = \frac{Q}{ATX\, H/L}$$

K = Coefficient of permeability in cm/sec

Q = Quantity of in milliliters percolating over the complete period of test after reaching the consistent phase

A = Area of the specimens face in cm2

T = Time in seconds over which Q is determined

H/L = Ratio of the pressure head to the thickness of models

Table: 5.5 Permeability Related Properties of ESP Concretes

Mix designation	Symbol	Coeffietient of permeability $10^{-10m/s}$	Coeffietient of water absorption $10^{-10m2/s}$
		28 Days	28 Days
A0	OPC	1.72	2.01
A1	2.5FA2.5RHA5ESP	1.61	2.26
A2	5FA5RHA5ESP	1.51	1.93
A3	10FA10RHA5ESP	1.37	1.68
A4	15FA15RHA5ESP	1.19	0.93
A5	20FA20RHA5ESP	1.22	1.35

5. RESULT AND DISCUSSION

5.1 Compressive Strength Of Concrete

The compressive strengths of concrete for various proportions are pictured in Table 5.1 Evaluation of the data for 7, 14 and 28 days of curing period produce the fact that the compressive strength increase up to R4 (15FA15RHA5ESP). At R5, the compressive strength goes down to a value below that of control mix concrete. Hence, R3 (15FA15RHA5ESP) is taken as an enhancement in strength as depicted in Table 5.3

The results of the compressive strength of concrete for 7, 14 and 28 days of curing time are shown in Table 6.4. It is very clear from the present study that, the compressive strength enhances in combine description of R3 (15FA15RHA5ESP) and thereafter come down with R5. The amorphous silica and the fine particle size of rise husk ash and FA are the underlying causes for the sterling pozzolanic function and calcium content of egg shell powder enhancement in compressive strength.

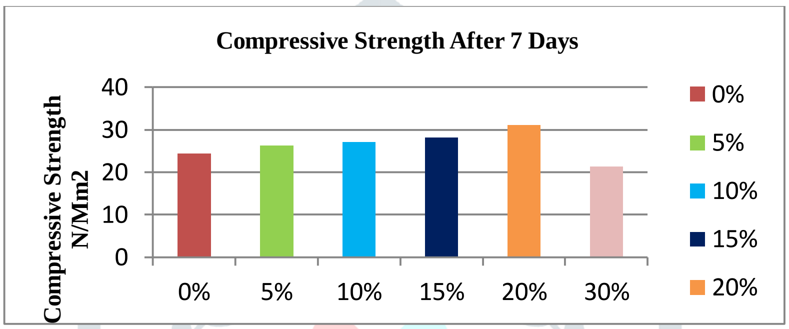

Fig. 5.1 compressive strength after 7 days

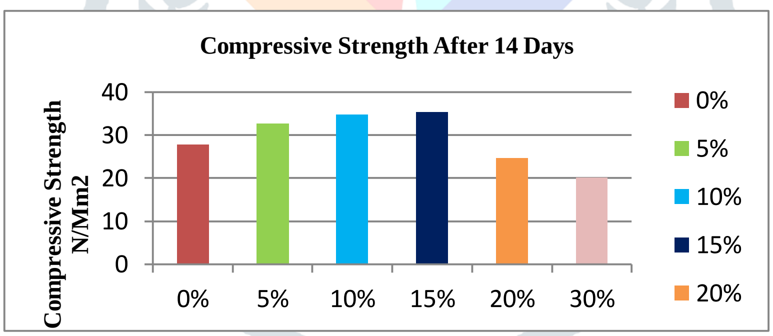

Fig. 5.2 compressive strength after 14days

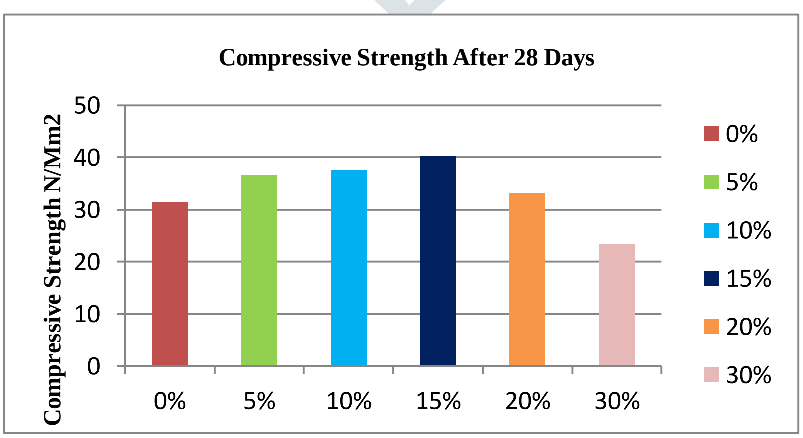

Fig.5.3 compressive strength after 28 days

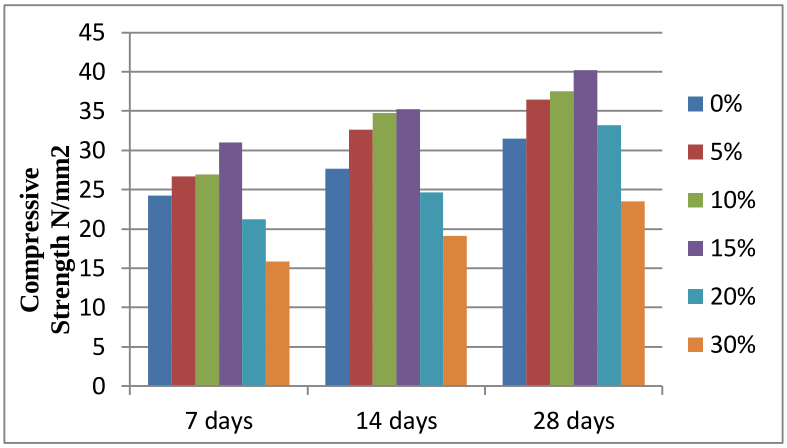

Fig. 5.4 Strength Development after 7, 14 And 28 Days

5.2 Splitting Tensile Strength

Splitting tensile Strength of various proportion of concrete after 7days and 28 days of curing are shown in fig. 5.6 It is explicit that splitting tensile strength value increase up to R1- R4 and then at R5 is roughly equal to that of control mix concrete. Thus R4 content is the finest limit.

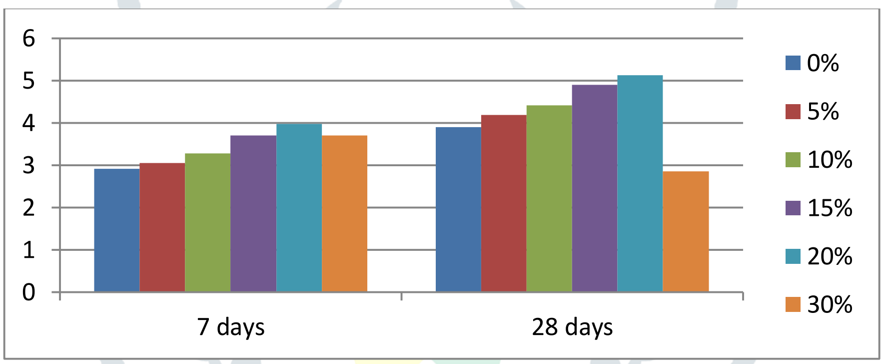

Fig 5.6 Splitting Strength Development After 7days And 28 Days

5.3 Flexural Strength Of Concrete

Figure 5.7 shows outcome of flexural tensile strength by means of beam specimen of using different proportion of concrete. Beams were investigated after 7days and 28days curing for flexural strength. It was observed that highest flexural strength was achieved at 20 %. Thereafter at 30% flexural strength is roughly indicated to that of control mix concrete.

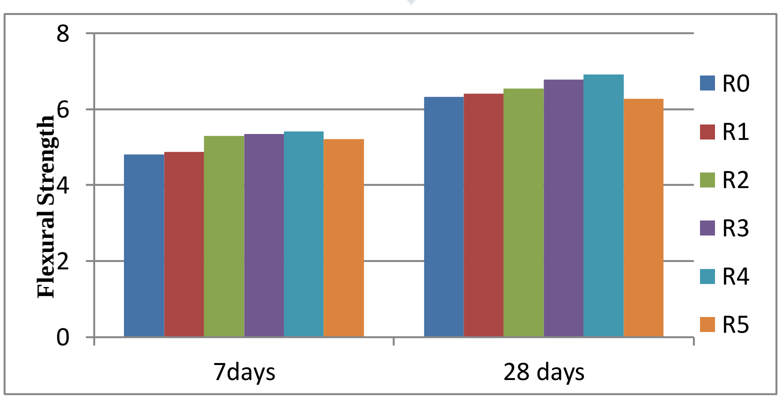

Fig. 5.7 flexural strength after 7 days and 28 days

5.4 Coeffitient Of Water Absorption Test

Figure 5.8 gives details of the coefficients of water absorption of different proportioning concrete specimens after 28 days curing. It is observed that, coefficient of water assimilation is enhancement in substitution 5% i.e. R1 and gradually comes down with raise in substitution R2 to R4. At 30 % there is an enhancement in coefficient of water absorption and these values are lesser than those of control mix concrete specimens, Hence the fact that FA, RHA result in a decrease of permeable voids.

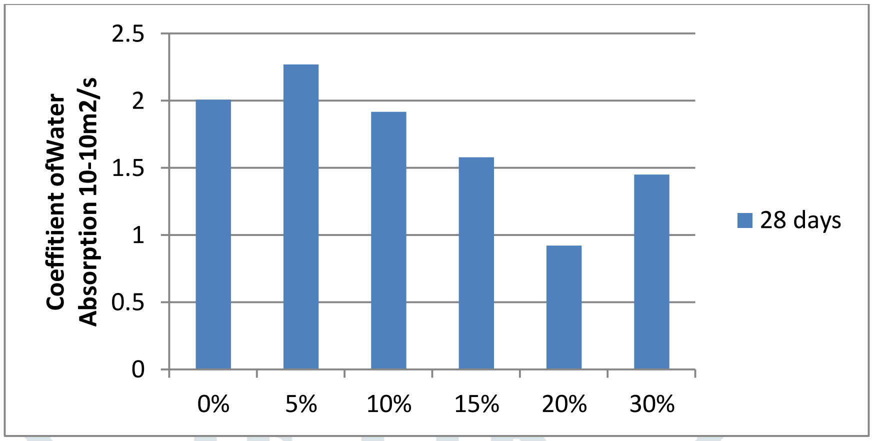

Figure 5.8 Coefficient of water absorption after 28 days

5.5 WATER PERMEABILITY TEST

Figure 5.9 shows the coefficient of permeability of the concrete mixes taken at 28 days. From the graph it is clear that different proportion of concretes mixes are less porous than the control mix concretes, and is indicating that the coefficient of permeability for different proportions of concrete incessantly decreases with R1 to R4. At 20%, 30% it leads to a raise in permeability with the values being lesser in relation to those of control mix concrete. This happens due to the pozzolanic materials (RHA & FA) tends to absorb the vacant space in the pore composition and significantly cuts down the permeability of the concrete.

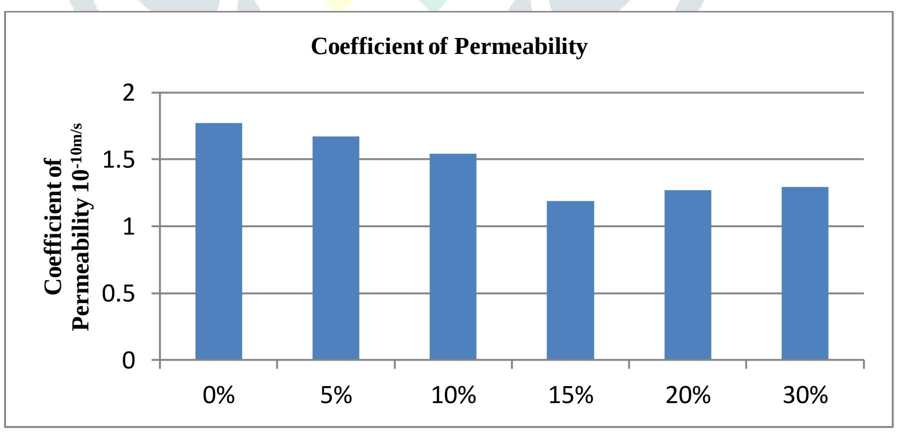

Figure 5.9 Coefficient of permeability after 28 days

6. CONCLUSION

Following conclusion have been drawn from the present study

1. Utilizing waste fly ash, rise husk ash and egg shell powder it is conceivable to diminish the utilization of concrete and the related vitality interest effect on air contamination and Co2 emanation, the compressive strength of concrete is higher than that of the control. Over 20% use of fly ash and rise husk ash the quality of concrete significantly decreases.

2. The combine proportion of R3 (15FA15RHA5ESP) improves the strength and permeability of concrete. These properties were distinguished to ensure concrete to substitute concrete. Hence factors of concrete are considerably better to the control mix concrete. Hence strengthen concrete buildings results in an enhanced plan life.
3. Considering the strength criteria, the replacement of cement by fly ash, rise husk ash and egg shell powder is feasible. Therefore we can conclude that the utilization of FA, RHA and ESP in concrete as cement replacement is possible.
4. The present study has exposed the fact that 15 % replacement of cement may be treated as finest creation in the view of developed value of compressive strength, water permeability, reduce chloride penetration and desirable functionality.
5. Used of FA, RHA and ESP in concrete will eradicate the disposal problem of waste material, reduce emission of harmful pollution by cement manufacturer industry into our environment and thus prove to be environment friendly.

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