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STUDY ON STRENGTH PROPERTIES OF FLY ASH, MICRO SILICA & RICE HUSK ASH AS A PARTIAL REPLACEMENT OF CEMENT IN CONCRETE

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ABSTRACT: Micro silica concrete provides the power traits in mission painting. Portland cement concrete another name of micro silica concrete which is natural materials and eco processes. For excessive CO_2 emission Portland cement is chargeable by reducing the micro silica concrete. Cumulative population also generates rising demand for food and energy wealth. Rice husk ash, for example husk and straw, can be combusted and used as a renewable energy source and under precise burning conditions, the subsequent ash can be used by means of a supplemental cementations solid or valuable filler in the manufacturing of concrete, which can theoretically lead to condensed environmental impacts in concrete. Massive amount of Portland cement is obtained for maximum flexible Concrete based on cloth. Massive quantity of carbon dioxide is obtained by manufacturing Ordinary Portland Cement (OPC) which pollutes the atmosphere. Chemical movement of inorganic molecules is produced based on Micro silica concrete. The performance of fly ash, rice husk ash & micro silica concrete with different replacement levels under conventional and accelerated curing was studied. the specimens were casted and tested at different replacement levels of 5%,10% and 15%.Here cement is partially replaced with fly-ash and micro silica rice husk ash. The compressive strength and spilt tensile strength of the concrete mixes under conventional and accelerating curing were tested and the test results are noted. Fly –ash based micro silica concrete for 28 days curing are showing high strength values when compared with accelerating curing and conventional curing specimens. Rice husk is a rice by-product manufactured when harvesting paddy. Each kg of milled rice manufactured results in roughly 0.8–1.5 kg of rice husk contingent on variability, wounding height of the stubbles, and dampness content during ingathering. Rice husk is detached from the grains after the plants are threshed either by hand, using standing threshers or, more recently, by means of combine harvesters.

Keywords: Accelerated curing, traditional curing, micro silica, fly-ash, rice husk ash and ordinary portland cement.

I. INTRODUCTION

The worldwide utilization of cement is second just to water. As the interest for concrete as a development material increments, So additionally the interest for Ordinary Portland Cement (OPC). It is assessed that the creation of concrete will increment from around 1.5 billion tons in 1995 to 2.2 billion tons in 2010. Then again, Theclimate change due to a dangerous atmospheric devation as turned into a main pressing issue [1]. The an Earth-wide temperature boost is brought about by the outflow of ozone harming substances like Carbon dioxide (CO2), to the climate by human exercises.

Among the ozone depleting substances, CO2 contributes around 65% of an Earth-wide temperature boost. The concrete business is considered liable for a portion of the CO2 discharges, in light of the fact that the development of one tone of Portland concrete emanates roughly one ton of CO2 in to air. A few endeavors are underway to decrease the utilization of Portland concrete in concrete to address to a worldwide temperature alteration issues [2]. These incorporate the usage of strengthening establishing materials, for example, fly debris, silica seethe, and the advancement of elective covers to Portland concrete.

International Journal For Advanced Research In Science & Technology
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Colossal amounts of fly debris are produced from coal or lignite based Thermal Power stations. Fly debris has been for the most part considered as a waste material and put away in landfills/agrarian terrains giving genuine space issues, expected dangers of air contamination, defilement of water because of draining, and so forth Portland concrete production is turning out to be less satisfactory, because of the developing worries connected with asset use, bio variety protection and worldwide climatic change. Attributable to the evil impacts of concrete assembling process, the quest for elective cover material has turned into a test to scientists and technologists [3].

Concrete substitution materials play an undisputed part to play in the eventual fate of the development business In this regard, the miniature silica substantial Silica seethe, otherwise called miniature silica, is a shapeless (non-glasslike) polymorph of silicon dioxide. It is a ultrafine powder gathered as a result of the silicon and ferrosilicon amalgam creation and comprises of circular particles with a normal molecule breadth of 150 nm. The fundamental field of utilization is as pozzolanic material for elite execution concrete. Silica smolder is a ultrafine airborne material with round particles.

Miniature silica in concrete adds to strength and sturdiness two different ways: As a pozzolanicmaterial, miniature silica gives a more uniform conveyance and a more noteworthy volume of hydration items. As a filler, miniature silica diminishes the normal size of pores in the concrete glue [4]. Miniature silica adequacy as a pozzolanic material and as a filler relies generally upon its piece and molecule size which thusly rely upon the plan of the heater and the arrangement of the unrefined components with which the heater is charged.

The development business utilizes cement to a huge degree. Around 14 bln ton were utilized in 2007. Concrete is utilized in foundation and in structures. It is made out of granular materials of various sizes and the size scope of the created strong blend covers wide stretches. The general evaluating of the blend, containing paricles from 300 mm to 320 mm decides the blend properties of the solid. The properties in new state (stream properties and functionality) are represented by the Particle Size Distribution (PSD), yet in addition the properties of the solid in solidified state, for example, quality and strength, are influenced by the blend evaluating and coming about molecule pressing. One approach to additionally improve the pressing is to build the strong size range, for example by incorporating particles with sizes under 300 mm.

Power is the key for advancement of any country. Coal is a significant wellspring of fuel for creation of power in numerous nations on the planet. During the time spent power age huge amount of fly debris get delivered and opens up as a result of coal-based power stations. It is a fine powder coming about because of the burning of powdered coal - shipped by the vent gases of the heater and gathered in the Electro Static Precipitators (ESP). Transformation of waste into an asset material is a well established act of civilization. The fly debris opened up in coal based nuclear energy plant in the year 1930 in USA [5]. For its productive use, researcher began research exercises and in the year 1937, R.E. Davis and his partners at college of California distributed exploration subtleties on utilization of fly

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debris in concrete cement. This examination had established framework for its particular, trying & uses.

II. LITERATURE SURVEY

Morsy et.al (2013) The impact of perlite stacking on the warm resistivity, sun based reflectance and aberrant elasticity of Nanostructured Cementitious Binder is considered. The primary goal of this exploration is to establish underlying lightweight surface mixtures and to work on their warm resistivity and reflectivity with reasonable mechanical exhibitions as a surface compound. Portland White Cement (PWC) was somewhat subbed by nano earth.

Mohammad Reza Zamani Abyaneh et.al (2013) The creator have observed that the substantial delivered with Micro-silica and Nano-silica show higher levels of value in their compressive strength than the substantial which just have Micro-SiO2 in their blends. Examples with 2% Nano-SiO2 and 10% Micro-SiO2 had less water retention and more electrical opposition.

T.Shanmugapriya (2013) Concentrated because of silica seethe on M60 concrete and viewed that as 7.5% of silica rage substitution builds the greatest compressive strength, split rigidity and flexural strength.

Vermaajay et.al (2012) The creator have concentrated on the impact of miniature silica and the strength of cement with standard Portland concrete. They saw that silica seethe builds the strength of cement and decreases slim pores.

Dilip Kumar Singha Roy (2012) he has researched the strength boundaries of the substantial made with incomplete substitution of concrete by SF.

H.A. Aglan et.al (2011) this study pointed toward examining the job of ultra fine sand (UFS) in improving the mechanical and acoustic properties of cementitious glues. The miniature underlying beginning of these properties was likewise distinguished and contrasted with the regular materials. The most extreme molecule size of the UFS utilized was 100 μm (100 percent passing) while half of the UFS had under 20 μm in breadth. Ordinary Portland cement (OPC) was somewhat subbed by UFS at 1%, 2%, 3%, 4%, 5%, 7.5% and 10% by weight of cover. The mixed mixtures were arranged utilizing the standard water of consistency.

Ye Qing et.al (2007) he have concentrated because of silica seethe and nano silica independently on new concrete and solidified concrete and observed that consistency and setting times were different for NS and SF. NS makes concrete glue thicker and sped up the hydration interaction which further develops the bond strength and compressive strength when contrasted and that of SF in concrete.

Ji (2005) The creator have concentrated on the water penetrability safe conduct and miniature construction of cement with NS and saw that NS concrete has a preferable water safe porousness over standard cement.

III. METHODOLOGY

The methodology used for making the conventional concrete is given below. It consists of mainly four steps.

Step 1: Preparatory modules

- Collection of materials
- Mix design for the work M40 grade concrete.

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Step 2: work planned

- Casting of 3 cubes, 3 cylinders and 3 beams in conventional method
- Coarse and fine aggregate ratios = 1.60
- Water- cement ratio = 0.4

Step 3: Specimens and testing

- Specimens are casted for every mix
- Compressive, split tensile and flexural testing are done at 28 days under normal curing condition – 3 samples each.

Step 4: Results

Results are noted after 28 days under normal curing condition and mean results are calculated for respective compressive strength of cubes, split tensile strength of cylinders and flexural strength of beams.

IV. EXPERIMENTAL STUDY ON MATERIALS

Following are the various test performed on materials like cement, fly ash, micro silica, fine aggregate and coarse aggregate. It is also studied about the chemical composition of fly ash, micro silica and sand.

Study on cement

- Specific gravity
- Standard consistency
- Initial setting time
- Final setting time
- Fineness
- Soundness

Table 1: Specific gravity of cement

Sr. No	Description	Weight (Kg)
1	Empty weight of empty bottle ($w_{1)}$	0.455
2	Empty weight+ water (w_2)	1.125
3	Empty weight + kerosene ($w_{3)}$	0.980
4	Empty weight +kerosene+ cement (w_4)	1.025
5	Weight of cement	0.050

From table 1 specific gravity of cement is performed by taking the empty weight of bottle, weight of water, weight of kerosene and weight of cement. And specific gravity is determined as 3.12.

Test results: The following results are obtained from laboratory tests

- Soundness of cement
  = 0.53mm
- Fineness of cement
  = 95%
- Standard consistency
  = 32%
- Initial setting time
  = 30 min
- Final setting time
  = 350 min for the future test

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Tests on Fly ash cement:
This gives the chemical properties of fly ash containing different elements like aluminium oxide, iron oxide, calcium oxide, sodium oxide, potassium oxide, magnesium oxide and silica at various experimental values. It contains a major portion of silica and magnesium oxide in small quantity.

Tests on Micro silica cement:
Micro silica in concrete adds to strength and toughness two different ways: as a pozzolana, miniature silica gives a more uniform conveyance and a more prominent volume of hydration items; as a filler, miniature silica diminishes the normal size of pores in the concrete glue. Utilized as an admixture, microsilica can work on the properties of both new and solidified cement. Utilized as a halfway swap for concrete, microsilica can fill in for energy-consuming concrete without penance of value.

Expansion of microsilica to a substantial blend changes the concrete glue structure. The subsequent glue contains a greater amount of the solid calcium-silicate hydrates and less of the feeble and effectively solvent calcium hydroxides than do standard concrete glues. Since the microsilica particles are so little they scatter among and separate the concrete particles. The subsequent fine, uniform network can give notably higher compressive and bond strength.

Tests on fine aggregate:
In the present investigation, the river sand, which was locally available, was used as fine aggregate and the following tests were carried out on sand. The specific gravity test conducted on fine aggregate in the laboratory for calculating the mix design, values observed. River sand and gravel provide greater workability to concrete than crushed sand. For a given volume or weight, it has less surface and less void, so abundance glue is accessible to give better greasing up impact. Because of adjusted shape it has less contact obstruction. In light of the previously mentioned reasons adjusted total shows a high functionality when contrasted with precise, flaky or prolonged totals.

Test on coarse aggregate:
Locally available crushed blue granite stone aggregate of size 20mm and less was used and the various tests were carried out on the aggregate are given below. The specific gravity test conducted on coarse aggregate in the laboratory for calculating the mix design, values observed are tabulated below.

Sieve analysis have conducted for coarse aggregate having sizes at 20mm, 16mm, 12.5mm,10mm, 4.75mm. Most of the aggregate is passed through 20mm size and shape of the aggregate selected is round in shape which as high workability.

Casting and Testing of cubes:
For every mix 3 cubes were casted at replacement levels of cement as

- 10% (5% fly ash + 5% micro silica)
- 20% (10% fly ash+ 10% micro silica)
- 30% (15% fly ash+ 15% micro silica)

Accelerated curing and conventional curing is adopted and compressive strength results were taken.
Mixing concrete is simply defined as the "complete blending of the materials which are required for the production of a homogeneous concrete". This can shift from hand to machine blending, with machine

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blending being the most widely recognized. The effective situation of cement is reliant upon cautious blending, the appropriate gear, and satisfactory transportation. This site will characterize, investigate, and show the significance of each in the general course of setting concrete. Quality confirmation, reasonable plan of materials and hardware, and right weighing of the materials are the fundamental advances that should be finished before any blending happens.

Accelerated Curing:

Sped up relieving is any technique by which high early age strength is accomplished in concrete. These methods are particularly valuable in the pre-manufacture industry, wherein high early age strength empowers the evacuation of the formwork inside 24 hours, in this manner lessening the process duration, bringing about cost-saving advantages. The most normally taken on relieving strategies are steam restoring at air pressure, warm water relieving, bubbling water restoring and autoclaving. A commonplace relieving cycle includes a preheating stage, known as the "defer period" going from 2 to 5 hours; warming at the pace of 22 °C/hour or 44 °C/hour until a most extreme temperature of 50−82 °C has been accomplished; then, at that point, keeping up with at the greatest temperature, lastly the cooling period. The entire cycle ought to ideally not surpass 18 hours.

V.RESULTS AND DISCUSSION

Preliminary Tests

In the first stage of the project work, the theoretical investigation and literature review are carried out and the following results are obtained.

- 3.12 is obtained for the specific gravity of cement tested
- 2.4 is obtained for the specific gravity of the fine aggregate tested
- 2.6 is obtained for the specific gravity of coarse aggregate tested
- 2.1 is obtained for the specific gravity of fly-ash
- 2.15 is obtained for the specific gravity of rice husk ash
- 2.2 is obtained for the specific gravity of micro silica
- 2.47 is obtained for the Fineness modulus of the fine aggregate tested
- 2.9 is obtained for the Fineness modulus of the coarse aggregate tested
- 95% is obtained for the Fineness of cement
- 92% is obtained for the Fineness of fly ash
- 95% is obtained for the Fineness of micro silica
- 0.53mm is obtained for the Soundness of cement
- 197 L Water content for the mix is used
- 438 kg /m^3 Bulk density of cement
- 696 kg /m^3 Bulk density of fine aggregate
- 956 kg /m^3 Bulk density of coarse aggregate
- 1.40 is obtained for the aggregate ratio of this mix is
- 1:1.6:2.2 mix design for m_{40}concrete arrived
- 1:1.5:2.18 mix design for fly ash based micro silica concrete arrived

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Table. 2: COMPRESSIVE STRENGTH OF FLY ASH RESULT FOR CUBES

S.no	replacement levels	compressive strength for 7 days	compressive strength for 28 days	compressive strength for 56 days
1	0%	30.62	47.1	47.5
2	5%	32.85	40.55	41.1
3	10%	34.9	42.35	42.67
4	15%	35.1	42.55	53.33

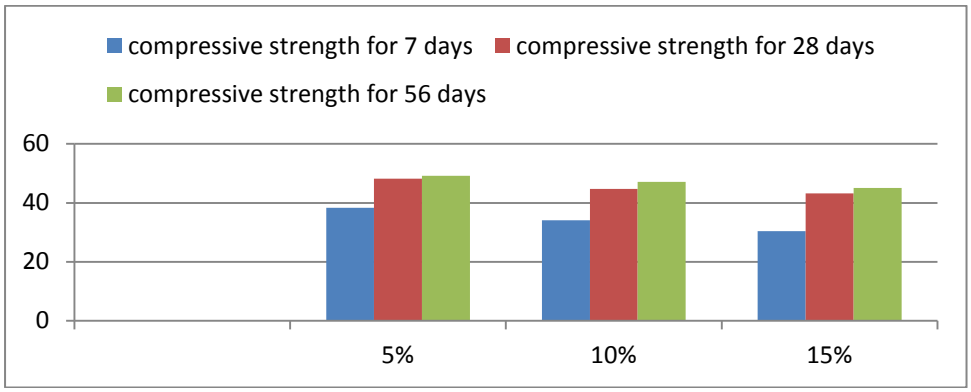

Fig. 1: : Compressive strength of fly ash concrete cubes

Table 3: Compressive strength of micro silica result for cubes

S.no	replacement levels	Compressive strength for 7 days	compressive strength for 28 days	compressive strength for 56 days
1	5%	28.75	41.62	41.77
2	10%	31.1	45.92	46.07
3	15%	32	44.73	44.76

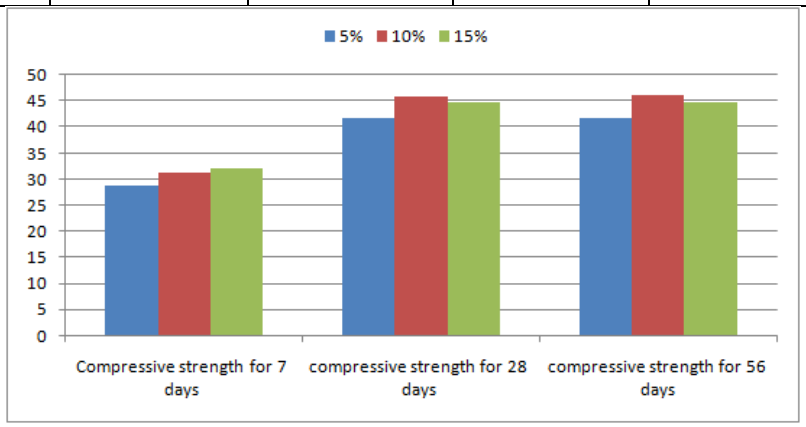

Fig. 2: Compressive strength of micro silica concrete

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Table. 4: Compressive strength of rice husk ash result for cubes

S.no	replacement levels	compressive strength for 7 days	compressive strength for 28 days	compressive strength for 56 days
1	5%	38.34	48.26	49.15
2	10%	34.12	44.72	47.08
3	15%	30.36	43.18	45.04

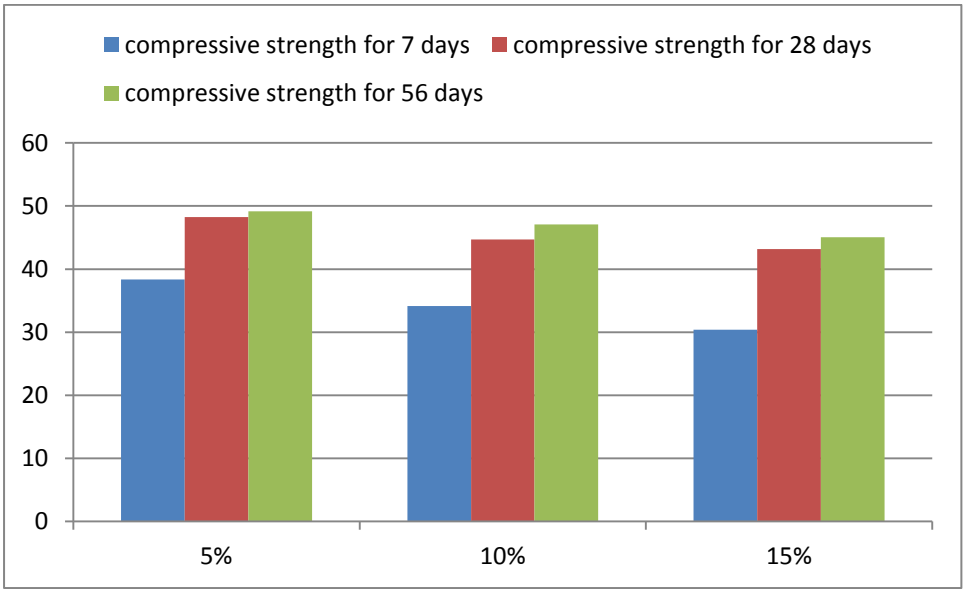

Fig. 3: Compressive strength of Rice Husk Ash concrete

Table. 5: Split tensile strength result for cylinders of fly ash concrete

S.No	replacement levels	split tensile strength for 28 days
1	0%	3.8
2	5%	4.24
3	10%	4.34
4	15%	4.70

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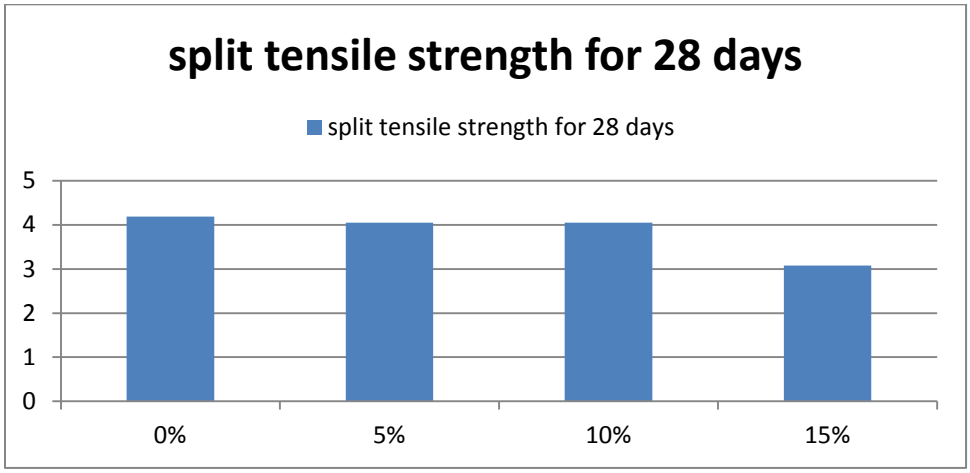

Fig. 4: Split tensile strength of concrete cylinder for 28 days

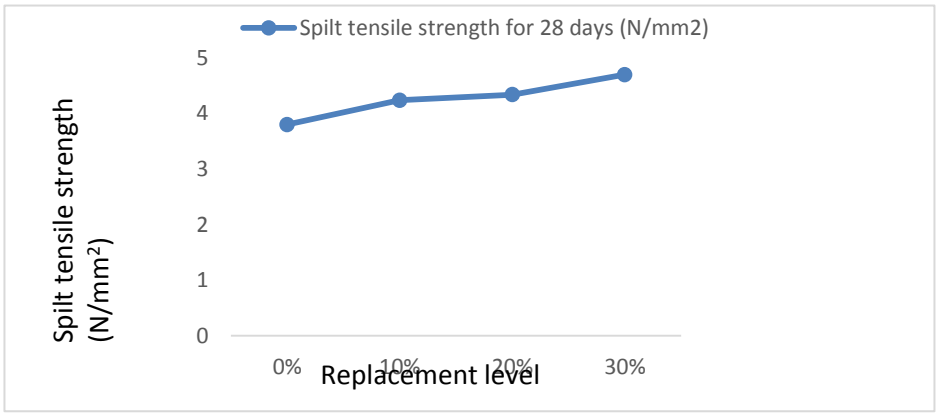

Fig. 5: Split tensile strength of cylinders of fly ash concrete

Table. 6: SPLIT TENSILE STRENGTH FOR MICRO SILICA

S.No	Micro Silica	split tensile strength for 28 days
1	0%	417
2	5%	4.12
3	10%	4.1
4	15%	3.99

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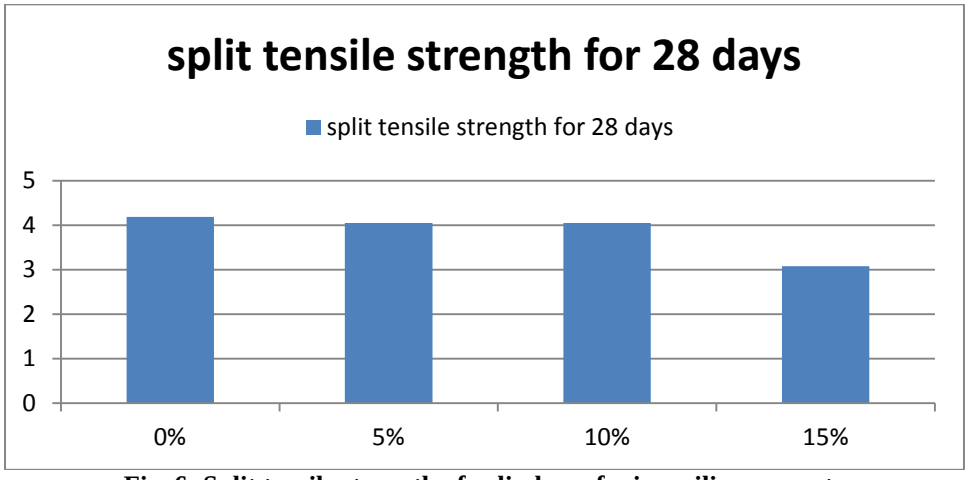

Fig. 6: Split tensile strength of cylinders of micro silica concrete

Table. 7: split tensile strength for Rice Husk Ash

S.No	Rice Husk Ash	split tensile strength for 28 days
1	0%	4.19
2	5%	4.05
3	10%	4.05
4	15%	3.08

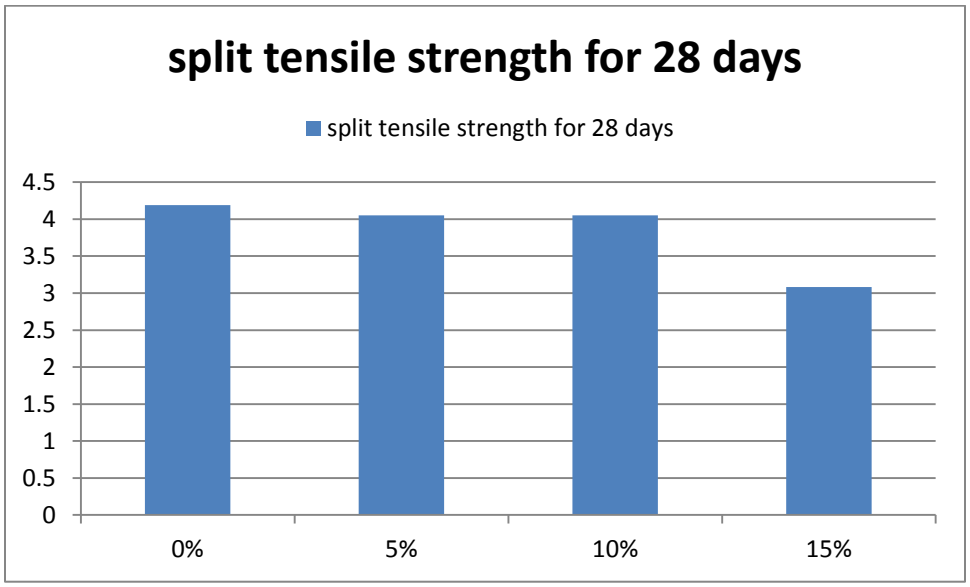

Fig. 7: Split tensile strength of cylinders of Rice Husk Ash concrete

VI.CONCLUSION

56 days curing is for strength of fly-ash, rice husk ash, micro silica concrete. It is compared with conventional concrete based on grade M40.

- Higher compressive strength is obtained Fly ash for 5%, 10% & 15% replacement of cement in concrete with it's done based on the concrete mix cubes for 56 days

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curing.

- (5% fly ash) is replaced with replacement of cement
- When 5% is using of flyash gently decreased(when 5% of flyash replaced of cement) compressive strength is increased at 56 days when compared to otherpercentages of concrete mixes.
- (10% fly ash) is replaced gently decrement decrease the compressive value
- (15% of fly ash) is replaced 18.33 N/mm^2 increased
- Fly-ash, rice husk ash & micro silica concrete mix cylinders are increased at 28 days with replacement of cement
- Split tensile is also a fly ash using of replacement in cement in concrete the better results out comes it
- Fly ash is used in partially replaced of cement on split tensile strength is increased for 28 days curing compared to other concrete mixes

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