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A Study on Mechanical Properties of Modified Concrete using Rice Husk Ash & Silica Fume

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ABSTRACT: In the last decade, the use of supplementary cementing materials has become an integral part of high strength and high performance concrete mix design. These can be natural materials, by-products or industrial wastes, or the ones requiring less energy and time to produce. Some of the commonly used supplementary cementing materials are fly ash, Silica Fume (SF), and Rice Husk Ash (RHA) etc. RHA is a by-product material obtained from the combustion of rice husk which consists of non-crystalline silicon dioxide with high specific surface area and high pozzolanic reactivity. It is used as pozzolanic material in mortar and concrete, and has demonstrated significant influence in improving the mechanical and durability properties of mortar and concrete. This paper presents an overview of the work carried out on the use of RHA as partial replacement of cement in mortar and concrete. Reported properties in this study are the mechanical, durability and fresh properties of mortar/concrete.

KEYWORDS: Cement, Concrete, Silica Fume, Rice Husk Ash.

I. INTRODUCTION

Concrete, is most generally utilized man made development material and is the biggest creation of the considerable number of materials utilized as a part of development industry. Concrete is fundamentally made of cementitious materials which need to legitimately tie themselves together, and additionally with different materials to shape a strong mass. Cement or mortar is comprised of concrete, water and totals (coarse and fine total) and some of the time with fundamental admixtures. Where the Cement is an industrial material and aggregate (coarse and fine) and water are naturally available materials in concrete, fine and coarse aggregates constitute about 75 % of its total volume. It is, therefore, important to obtain the right type and good quality aggregates at site. The aggregates form the main matrix of the concrete mortar.

Development action in India amid the most recent decade has dramatically increased. The huge leap forward in programming, IT and BPO enterprises has given another beam of would like to huge number of white collar class Indian families particularly in urban regions where there can be parcel of change in foundation with the advancement and globalization of Indian economy. Concrete has been the most favoured development material for more than five decades. It is by and large progressively utilized step by step everywhere throughout the world because of its flexibility, mould ability, high compressive quality and numerous more points of interest. Subsequently the utilization of concrete as a development material has expanded.

Cement concrete, as it is known today, came into use with the invention of Portland cement around 1824. Until then lime-pozzolana mortar and concretes were used throughout the world. The term pozzolana is used to indicate a material, which reacts with lime to make a product with cementitious properties. However, their relatively slow setting and hardening characteristic of lime-pozzolana mortar and concretes was the reason for their gradual decline. The main advantage of Portland cement is its considerable faster rate of setting and hardening, even under water. It replaced all the traditional binding materials and became a unique and universally accepted construction material. The application of Portland cement in concrete industry became extensive in practice with steel reinforcement.

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II. LITERATURE REVIEW

SILICAFUME

ArnonChaipanich, Chiang Mai, Thailand, 2 examined physical portrayal, for example, molecule size and morphology of silica fume, utilizing a Scanning Electron Microscope (SEM; JEOL JSM-840A) and Energy Dispersive X-beam spectrometer. Besides, the impact of silica fume on the compressive quality was likewise researched.

For compressive quality test, concrete of 100x100x100 mm 3D squares were thrown, utilizing a water to fastener proportion of 0.45 (cement content = 410kg/m³). Silica fume was utilized to supplant Portland cement by coordinate weight at 5, 10, 15 and 20%. Characteristic sand and smashed coarse totals (20 mm greatest) were utilized for all blends. A superplastizing admixture confirming to BS 5075: section 3 was utilized to keep up an ostensible drop of 75 mm. The specimens were demoulded and cured in water at 20°C for a predefined period (1 to 28 days). Subsequent to curing, concrete examples were tried for compressive quality as per BS 1881: section 116. The outcomes demonstrated that Silica fume was found to comprise of basically SiO₂ at 95.3%. At the point when tried utilizing EDS method, it can be seen that silica fume is round fit as a fiddle with its run of the mill molecule measure of ≈ 100 nm. The impact of silica fume on compressive quality of concrete up to 28 days and the relative quality outcomes contrasted with Portland cement concrete. It was discovered that at early quality (1–2 days), the quality of silica fume concrete was marginally not as much as that of PC concrete. Nonetheless, at later stage (from 7 days on), the compressive quality was found to increment fundamentally with expanding level of silica fume in the blends.

It was finished up Silica fume is observed to be 100nm in estimate and consequently is the finest part ever to be utilized to make cements or concrete up until now. Its normal molecule estimate when contrasted with that of Portland cement is just about 100 times littler in term of the distance across size of the molecule.

Improved compressive quality from the utilization of silica fume at 28 days was found. The compressive quality was found to increment fundamentally with expanding level of silica fume utilized as a part of the blends. Most prominent increment in quality can be found in the concrete blend with silica fume at 20%. This is believed to be because of enhanced densification of the cement lattice and further more to more grounded holding in the between facial zone between the cement glue and totals.

D.L. VenkateshBabu and S.C. Natesan, carried out investigations with a water-cementitious ratio 0.32. The effect of varying amounts of replacement of cement, that is, of 2.5, 5, 7.5, 10, 12.5 and 15 percent with Condensed Silica fume (CSF) was studied with both Ordinary Portland Cement (OPC) and Portland Pozzolana Cement (PPC). The compressive strength, split tensile strength and flexural strength of the mixes were investigated as per the IS specifications. Mix design was carried out by absolute volume method; a concrete mixture with a characteristic mean strength of 60 MPa was designed with an aggregate/cement ratio of 3.56 and water binder ratio 0.32. For each of CSF replacement concrete cubes, cylinders and beam specimens were casted. In light of the testing result at 28 days curing it was discovered that the most extreme compressive quality of concrete in mix with CSF relies upon two parameters to be specific the replacement level and the period of curing. The ideal replacement of CSF for accomplishing most extreme quality in OPC and PPC was seen to be 7.5 and 5 percent, individually, for every one of the periods of curing. It was watched that the elasticity at 28 days time of curing was around 7 percent of compressive quality for OPC and 6 percent of the compressive quality for PPC. For flexural quality at 28 days period of curing was around 10 percent of compressive quality for OPC and 8.5 percent of the compressive quality for PPC. To consider the corrosive resistance of concrete, the 3D square examples were cured for 28 days and afterward drenched in 2.5 percent HCl and 2.5 percent H₂SO₄ arrangements up to 90 days, it was watched that the expansion in rate of CSF diminishes the loss of weight in concrete. Based the previously mentioned information it can be inferred that the utilization of CSF is vital for the production of elite concrete.

The rate of increment of split elasticity with compressive quality is less, the proportion of rigidity to compressive quality reductions with increment in compressive quality. Elasticity does not increment altogether with an expansion in CSF content. Silica fume concrete has more imperviousness to H₂SO₄ and HCl contrasted with plain concrete blend.

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RICE HUSKASH

G.A. Habeeb, and M.M. Fayyadh, driven an exploratory examination on the effect of Rice Husk Ash (RHA) Average Particle Size (APS) on the mechanical properties and drying shrinkage of the conveyed RHA blended bond. Secretly made RHA with three deferent APS (i.e., 31.3, 18.3, and 11.5 μm , independently) were used to supplant bond by 20 % of its weight. Mix proportioning was performed to make high workability RHA mix (200-240 mm hang) with target nature of 40MPa. Joining of RHA in concrete achieved extended water ask for, for the mechanical properties, thought of RHA gave relative or overhauled mechanical properties when diverged from the control Ordinary Portland Cement (OPC) mix, with better RHA giving better change. Fine RHA demonstrated the most amazing shrinkage regard as a result of the effect of micro fine particles which extends its shrinkage regards stunningly.

Muhammad Harunur Rashid, Md. Keramat Ali Molla and TarifUddin Ahmed, presents the effects of using Rice Husk Ash (RHA) as a mostly solid substitution material in mortar mixes. This work relies upon a trial examination of mortar made with Ordinary Portland Cement (OPC) and 10%, 15%, 20%, 25% and 30% of OPC supplanted by RHA. The RHA used was gotten from uncontrolled auto start of rice husk, in a chamber, without control of temperature and devouring time. Sifter no 200 was used to sieve the blazing garbage in conclusion assemble the passing soot. The mechanical properties inspected were the compressive quality, and besides the porosity of mortar was attempted. The got comes to fruition show that the quality and porosity of mortar joining RHA were better, up to 20% of solid substitution level.

Dao Van Dong, Pham DuyHuu, and Nguyen Ngoc Lan, presents a few key properties of high quality solid utilizing rice husk fiery remains (RHAs). RHAs acquired from two sources: India and Vietnam were utilized with different substance to halfway trade for bond folio in high quality cement. Key properties of cement, including: droop, thickness, compressive quality, water and chloride penetrability resistances, were explored in correlation between tests without utilizing RHA and tests utilizing two sorts of RHAs. Trial comes about demonstrated sensible changes in compressive quality, water and chloride porousness resistances of solid utilizing the RHAs. The outcomes additionally exhibited that the upgrades of tests formed the India RHA was vastly improved than that of the Vietnam RHA. The usage of RHA in cement can acquire a few advantages. From one perspective, it adds to decrease of horticultural waste that is the fundamental driver of ecological issues in rural nations. Then again, it is a way to deal with enhance the nature of cement without utilizing expensive added substances, for example, silica smoulder.

III. MATERIALS USED

Cement:

In the present work, ordinary Portland cement of 53 grade Birla Super conforming to IS 12269:1987 has been used. The physical properties of cement obtained on conducting appropriate test as per IS 269/4831 and the requirements as per 4031 -1968 are given in Table

TABLE 1: PHYSICAL PROPERTIES OF CEMENT

Sl.no	Properties	Obtained values	As per IS12269-1987
1	Fineness(Blaine's air permeability test)	370 m ² /kg	Shall not be less than 225 m ² /kg
2	Soundness (by Le Chatelier's)	1.00 mm	Not more than 10 mm
3	1. Initial SettingTime	85.00 min	Not less than 30 min
	2. Final SettingTime	355.00 min	Not more than 600 min

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4	Compressive strength	55	Not less than 53 N/mm ²
5	Standard Consistency	30 %	
6	Specific Gravity	3.15	

RICE HUSKASH:

Rice Husk ash was collected and brought from Tumkur Rice Mill. The specific gravity is 2.10. Rice husk ash was finely grinded and passing through IS-200 micron sieve no was used.

SILICAFUME:

Condensed silica fume supplied by Corniche India Pvt Ltd, Navi Mumbai, was used, Physical and chemical composition of silica fume as provided by the manufacturer is as follows

FINE AGGREGATES:

Natural Sand

Locally available clean river sand is used. The physical properties of sand obtained on conducting sieve analysis and specific gravity tests tabulated in table

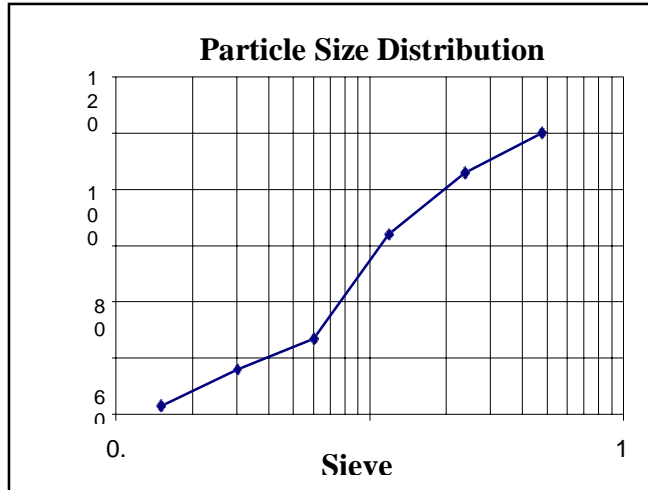


Figure 1: Graph showing sieve analysis of natural sand

TABLE 2: PHYSICAL PROPERTIES OF FA

Sl No	Property	Test Result
1	Specific gravity	2.66
2	Water absorption	0.6 %

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TABLE 3: SIEVE ANALYSIS DETAILS OF FA

IS Sieve designation	Natural Sand	Zone II
4.75 mm	100	90-100
2.36 mm	86	75-100
1.18 mm	64	75-90
600 micron	27	35-59
300 micron	6	8-30
150 micron	3	0-10

CoarseAggregate

Crushed stone of 20 mm maximum size and retained on IS 480 sieves has been used. Two different size of coarse aggregates were used. 60% of coarse aggregates passing through 20mm sieve size and 40% of coarse aggregate passing through 12.5 mm sieve size was used. The sieve analysis of coarse aggregates conforms to the specifications of IS 383: 1970 for graded aggregates and specific gravity.

Table 3.5: Physical Properties of CA

SI No	Property	Test Result
1	Specific gravity	2.66
2	Water absorption	0.4 %

TABLE 4: SIEVE ANALYSIS DETAILS OF CA (MAX SIZE 20MM)

IS Sieves	Cumulative Percent	
	Retained	Passing
20 mm	00	100.0
16 mm	9.00	91.0
12.5 mm	93.00	7.0
10.0 mm	99.20	0.8
4.75 mm	99.60	0.4

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TABLE 5: SIEVE ANALYSIS DETAILS OF CA (MAX SIZE 12.5MM)

IS Sieves	Cumulative Percent	
	Retained	Passing
12.5 mm	2.60	100
10.0 mm	23.6	97.4

Water: Clean potable water is used for mixing and curing of concrete.

IV.MIXPROPORTIONS

The mix design was carried out based on draft code IS: 10262: 2009. In this present work M-20 grade concrete was considered. Typical mix design calculation is shown in appendix A and test on trial mixes have been carried out. The mix proportion details are given in table

TABLE 6: MIX PROPORTION DETAILS

Mix Description	M-0	M-1	M-2	M-3
Silica fume (%)	0	25 %	20%	15%
RHA (%)	0	5%	10%	15%
Cement content(kg/m ³)	400	280	280	280
Silica fume (kg/m ³)	0	100	80	60
RHA (kg/m ³)	0	20	40	60
Water (kg/m ³)	180	220	220	220
Water cement Ratio	0.45	0.55	0.55	0.55
Fine aggregate(kg/m ³)	573.27	573.27	573.27	573.27
Coarse aggregate(kg/m ³)	1213.61	1213.61	1213.61	1213.61

V.TESTING PROCEDURES

Compression Test

Casting of cube specimens for compression test

The steel 3D square forms of size 150*150*150 mm were covered with oil on their internal surfaces and were set on level stage. The measure of cement, silica fume, rice quiet fiery debris, sand, and coarse totals required for 20 shapes were weighed according to the blend plan. The materials were first dry blended at that point blended with water. The workability tests droop, compaction factor, vee-honey bee consistometer were directed to determine the workability of

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the blend. Concrete was poured in to the moulds in three layers each layer being compacted utilizing mechanical vibrator. The best surface was done utilizing trowel. Following 24 hours concrete 3D squares were demoulded and the examples were kept for curing.

Testing of cube specimens for Compressive Strength of concrete

At each covered curing periods examples were removed from water and kept for surface drying. The shapes were tried in 3000kN limit compressive testing machine stacked at consistent rate of stacking at 145kg/cm²/min according to standard methodology clarified in May be: 516-1959(1999) to get the pressure quality of concrete.

Flexural Test

Casting of flexural beams specimens for flexural test the steel pillar moulds of size 500*100*100 mm were covered with oil on their inward surfaces and were put on level stage. The measure of cement, silica fume, rice quiet powder, sand, and coarse totals required for 6 bars were weighed according to the blend plan. The materials were first dry blended at that point blended with water. Concrete was poured in to the moulds in three layers each layer being compacted utilizing mechanical vibrator. The best surface was done utilizing trowel. Following 24 hours concrete bars were demoulded and the examples were kept for curing.

Testing of beam specimens for Flexural Strength of concrete

At each covered curing periods examples were removed from water and kept for surface drying. The shafts were tried in 3000kN limit stacked at consistent rate of stacking of 180 kg/min according to standard method disclosed in Seems to be: 516-1959 to get the flexural quality of concrete i.e. two point stacking. The places of two roller bolsters were checked and set likewise at those focuses on the roller underpins precisely.

Mortar Test

Casting of Mortar cube specimens

The mortar strong shape moulds of size 70*70*70 mm were secured with oil on their inward surfaces also, were determined to level stage. The measure of cement, silica fume, rice calm blazing remains and sand required for 6 mortar strong shapes were weighed by the standard test framework in light of IS: 4031: Part 6(1998). The materials were first dry mixed by then mixed with water. Mortar was poured in to the moulds in three layers each layer being compacted using mechanical vibrator. The best surface was finished using trowel. Following 24 hours mortar 3D shapes were demoulded what's more, the illustrations were kept for curing. Testing of Mortar cube specimens for

Compressive Strength of Cement

At each covered curing periods examples were removed from water and kept for surface drying. The mortar solid shapes were tried in 1000kN limit Uni-hub compressive testing machine stacked at steady rate of stacking of 35N/mm²/min according to standard method disclosed in Seems to be: 4031: Part 6(1998) to get the pressure quality of cement.

Normal Consistency Test

The goal of directing ordinary consistency test is to discover the water to be added to cement to get a glue of typical consistency i.e. the glue of certain standard robustness.

Typical consistency tests was done on the mortar blends made of cement, silica fume, rice husk fiery remains and sand with various rates of Silica fume and rice husk slag. Test outcomes are given in table

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TABLE 7 DETAILS OF NORMAL CONSISTENCY TEST

Mix Description	Silica Fume %	Rice Husk Ash %	Normal consistency
m-0	0	0	30 %
m-1	25	5	46 %
m-2	20	10	52 %
m-3	15	15	65 %

VI. RESULTS AND DISCUSSIONS

The **first part** consists of tests on fresh concrete such as workability in terms of slump, compaction factor and vee bee consistometer test immediately after mixing. The tests were carried out according to IS codes.

The **second part** consists of test results and discussions on compressive strength of normal concrete and modified concrete including silica fume and rice husk ash for different curing periods.

The **third part** consists of test results and discussions on flexural strength of normal concrete and modified concrete including silica fume and rice husk ash for different curing periods.

The **fourth part** consists of test results and discussions on compressive strength of modified mortar cubes including silica fume and rice husk ash for different curing periods.

Workability of Concrete

The following tests are employed to measure workability;

Slump Test

Compaction Factor Test

Vee Bee Consistometer Test

TABLE 8: DETAILS OF WORKABILITY RESULTS

Mix designation	Silica Fume (%)	RHA (%)	Compaction factor	Slump value (mm)	Vee – Bee Consistometer (in seconds)
M0	0	0	0.87	50	12
M1	25	5	0.84	34	24
M2	20	10	0.86	30	24
M3	15	15	0.91	30	21

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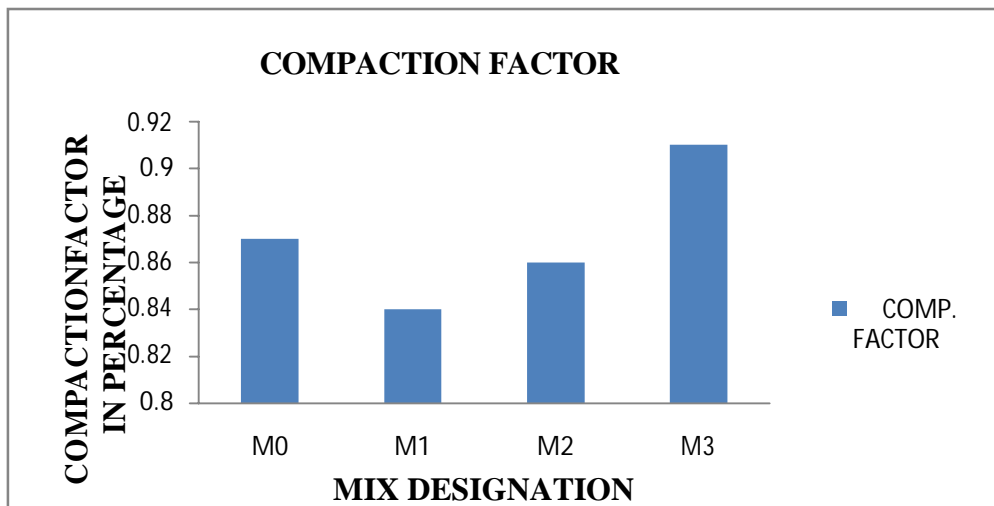


Figure 2: Graph showing comparison of Compaction Factor for different mixes

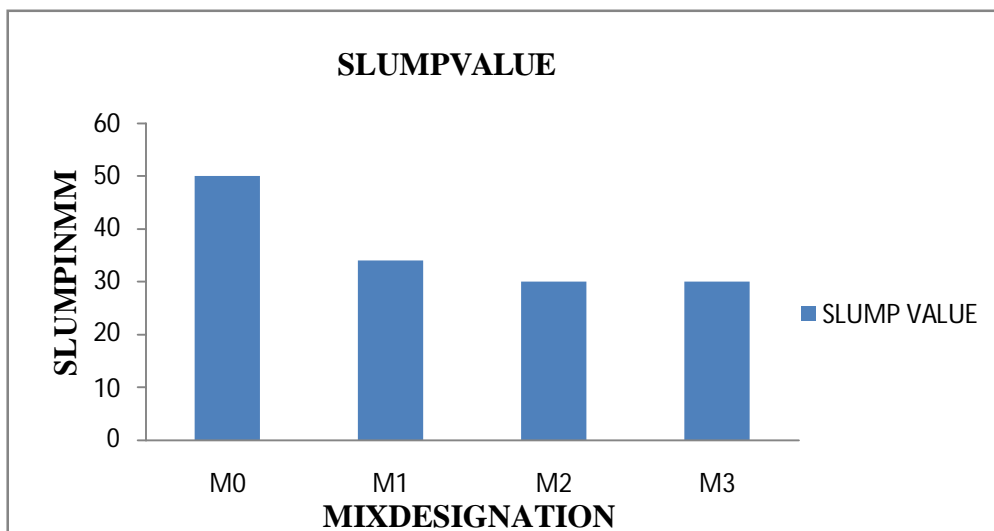


Figure 3: Graph showing comparison of Slump value for different mixes

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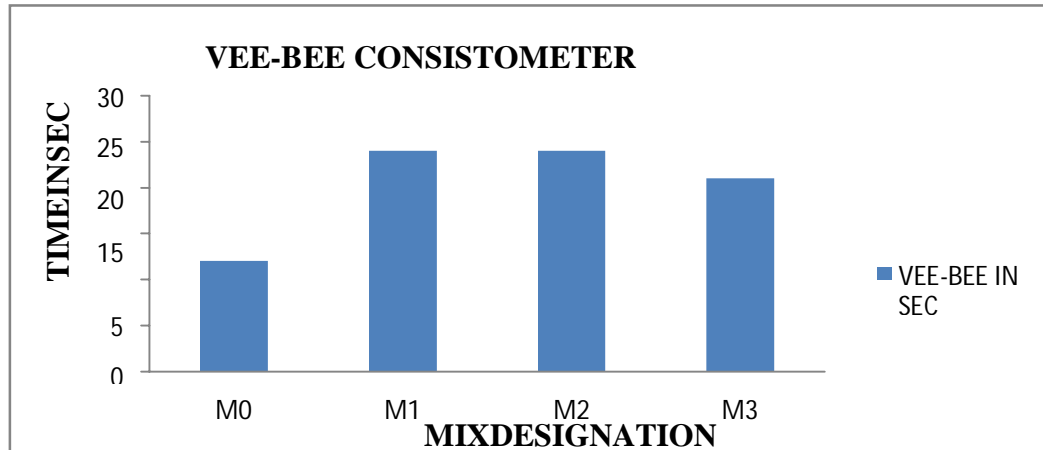


Figure 4: Graph showing comparison of Vee-Bee Factor for different mixes

Density of concrete

The test results of densities of M20 grade 28 and 56 days curing and densities of modified concrete with different silica fume and rice husk percentage for 28 and 56 days curing periods are given in Table 5.3.

The density of concrete on standard 150 mm cube is calculated using the formula

$$D = M/V \text{ kg/m}^3$$

M=is the mass of concrete in kg

V=is the volume of concrete in mm³

D= is the density of cube specimen in kg/m³

Table 9: TEST RESULTS OF DENSITIES OF CONCRETE

Mix designation	Silica Fume (%)	RHA (%)	Avg. Densities in Kg/m ³	
			28 days	56 days
M0	0	0	2524.93	2549.46
M1	25	5	2438	2458.93
M2	20	10	2378.6	2388.88
M3	15	15	2326.26	2357.06

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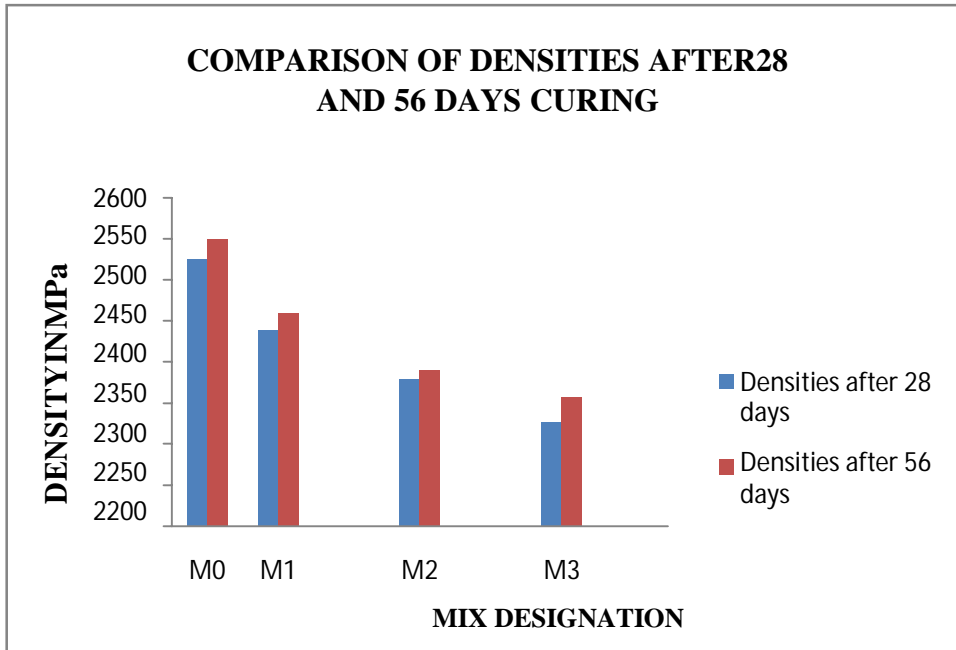


Figure 5: Graph showing comparison of Densities for different mixes

Compressive Strength of concrete

The compressive strength of concrete on standard 150 mm cube is calculated using the formula

$$f = P/A \text{ N/mm}^2$$

Where f ... is compressive strength of concrete in N/mm^2 , P ... is ultimate load resisted by concrete in Newton's, A ... is cross sectional area of cube specimen in mm^2

The test results of compressive strength of normal M-20 concrete and modified concrete is been showed in table

TABLE 10: TEST RESULTS OF COMPRESSIVE STRENGTH OF CONCRETE

Mix designation	Silica Fume (%)	RHA (%)	Avg. Compressive strength N/mm^2	
			28 days	56 days
M0	0	0	50.81	56.92
M1	25	5	31.76	49.93
M2	20	10	34.00	41.365
M3	15	15	27.21	34.25

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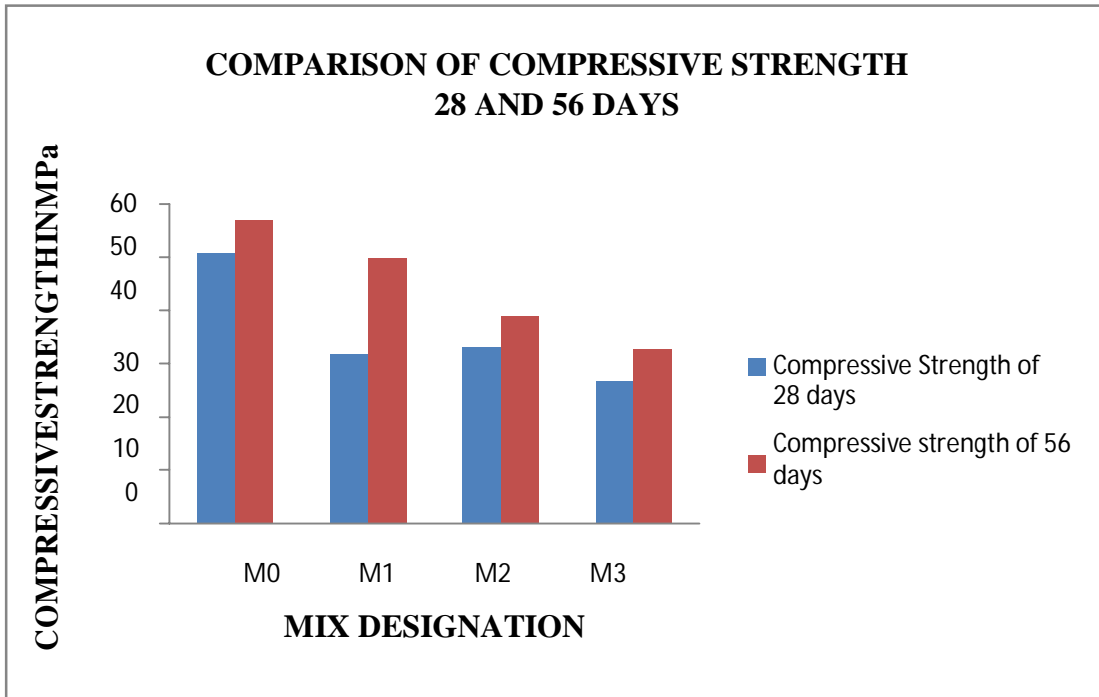


Figure 6: Graph showing comparison of 28 and 56 days compressive strength for different mixes

Flexural strength of concrete

The flexural strength of concrete on standard 100 x 100 x 500 mm prism specimens is given by the formula,

$$F_f = \frac{P L}{b d^2} \text{ N/mm}^2$$

Where P is failure load of specimen in Newton's

b is breadth of the specimen in mm

d is depth of specimen in mm

L is length of the specimen in mm

The test results of flexural strength of normal M-20 concrete and modified concrete is been showed in table

TABLE 11: TEST RESULTS OF FLEXURAL STRENGTH OF CONCRETE

Mix designation	Silica Fume (%)	RHA (%)	Avg. Flexural strength N/mm ²	
			28 days	56 days
M0	0	0	3.5	3.8
M1	25	5	2.9	3.2
M2	20	10	2.7	3
M3	15	15	2.4	2.7

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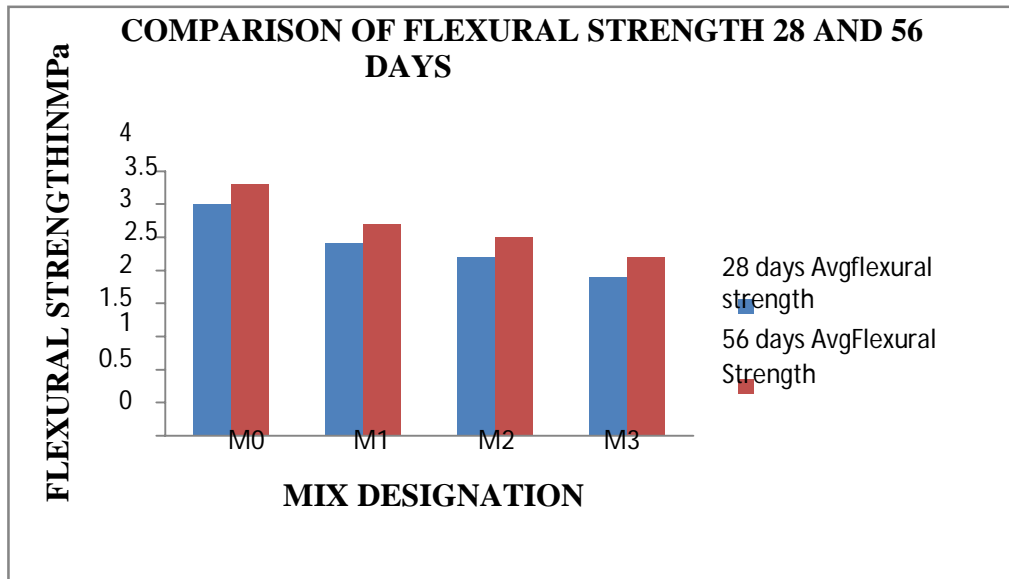


Figure 7: Graph showing comparison of 28 and 56 days flexural strength for different mixes

Compressive Strength of cementitious mortar including Silica Fume and Rice husk ash:

The compressive strength of mortar cubes on standard 70 mm cube is calculated using the formula

$$f = P/A \text{ N/mm}^2$$

Where $f...$ is compressive strength of mortar in N/mm^2

$P...$ is ultimate load resisted by mortar in Newton's

$A...$ is cross sectional area of mortar cube specimen in mm^2

The test results of compressive strength of modified mortar cubes is been showed in table

TABLE 12: TEST RESULTS OF COMPRESSIVE STRENGTH OF SF & RHA

Mix designation	Silica Fume (%)	RHA (%)	Avg. Compressive strength N/mm^2	
			28 days	56 days
m-1	25	5	11.077	11.545
m-2	20	10	9.075	13.947
m-3	15	15	12.67	12.27

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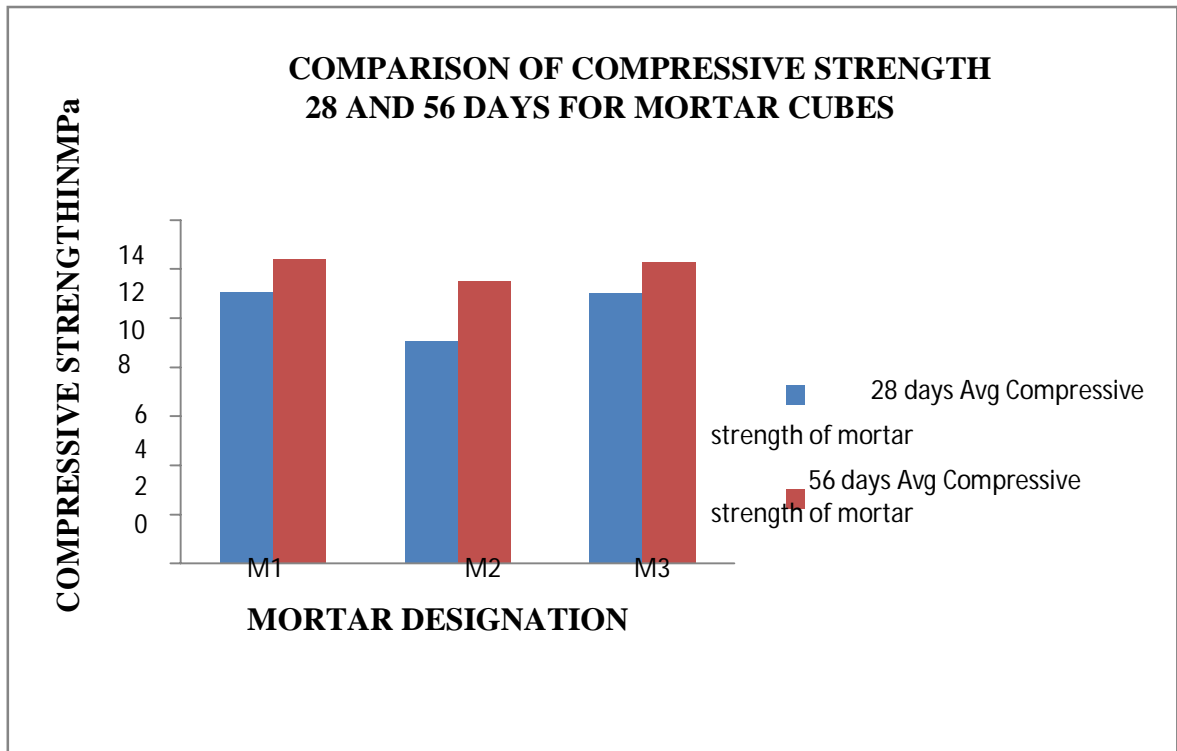


Figure 8: Graph showing comparison of 28 and 56 days compressive strength for different mortar mixes

TABLE 13: PROPORTION BY RATIO FOR NORMAL CONCRETE

Cement	Sand	CA	Water
1	1.433	3.03	0.45

TABLE 14: PROPORTION BY RATIO FOR SILICA FUME AND RHA CONCRETE

Mix Designation	Cementious Material			Sand	CA	Water
	Cement	SF	RHA			
M-1	0.7	0.25	0.5	1.433	3.03	0.55
M-2	0.7	0.20	0.10	1.433	3.03	0.55
M-3	0.7	0.15	0.15	1.433	3.03	0.55

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VII. DISCUSSIONS

1. The compressive strength, density & flexural strength for M20 concrete for both 28 days and 56 days is higher than the other proportions.
2. The compressive strength for M1 concrete is 31.76 Mpa and 49.93 Mpa for 28 days & 56 days respectively. The flexural strength for M1 concrete is 2.9 Mpa and 3.2 Mpa. This is higher than M2 and M3. The higher strength may be attributed to the content of Silica Fume.
3. The compressive strength for M2 concrete is 34 Mpa and 41.365 Mpa for 28 days & 56 days respectively the flexural strength for M2 concrete is 2.7 Mpa and 3 Mpa. The decrease in strength with respect to M1 can be attributed to increase in the RHA percentage and decrease in the percentage of silica fume.
4. The compressive strength for M3 concrete is 27.21 Mpa and 32.25 Mpa for 28 days & 56 days respectively. The flexural strength for M3 concrete is 2.4 Mpa and 2.7 Mpa as the percentage of silica fume is decreased, the strength has decreased.
5. The 28 days compressive strength of modified concrete (M1, M2, & M3) is less by (18%, 17%, & 23%) when compared to 28 days compressive strength normal concrete.
6. The 56 days compressive strength of modified concrete (M1, M2, & M3) is less by (7%, 13%, & 19%) when compared to 56 days compressive strength normal concrete.
7. However from the results it is seen that, even by replacing 30% of cement with silica fume and rice husk ash concrete of grade M20 can be produced.
8. The density decreases with increase in silica fume and rice husk ash percentage.
9. Workability decreases with increase in percentage replacement of silica fume and rice husk ash. This decrease in workability can be attributed due to water absorption by silica fume and rice husk ash.
10. The compressive strength of mortar cubes also increases in small percentages with the increase in silica fume percentage.

VIII. CONCLUSION

From the above results, it can be concluded that silica fume and rice husk ash can be effectively used in concrete. The inclusion of silica fume has desirable effect on concrete mechanical properties which is comparable to normal concrete.

- a) No difference in mode of failure was observed both in the case of beams and cubes when compared to normal concrete beams and cubes.
- b) There were no shrinkage cracks on finished surfaces
- c) There is significant increase strength gain after 28 days curing in all mix proportions, so it's of importance to consider its 56 days strength as characteristics strength while using as a structural material.
- d) Since the density of modified concrete decreases with increase in replacement percentages the mass of the structure can be reduced to a significant extent. There by reducing the dead loads makes structure more economical by using this modified concrete.
- e) Two of the major industrial by products silica fume and rice husk ash were used effectively in this project work, thereby making the concrete more sustainable material than normal concrete.

Scope of further studies

1. There are still many aspects of use of Silica fume Rice husk-ash modified concrete and in RCC structural members, which are yet to be studied before its use is standardized. The following is a list of the some possible areas where future expedient research may be directed.
2. Concrete using higher percentages of silica fume can be studied.
3. Further investigations on the mechanical properties such as stress-strain properties & durability of such concretes can be carried out.
4. Behaviour of concrete containing silica fume & rha to marine environment can also be studied.
5. Study on beams to be done in more detail and same work can be extended on slabs.
6. Reinforced sections can be casted and tested accordingly for this modified concrete.

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7. Investigations to study shrinkage and bond properties of Rice husk-ash and silica fume concrete.
8. Characterization study on Rice husk-ash collecting the samples from different sources so that they can be standardised for better application as alternate material in concrete.
9. Study on young's modulus of the modified concrete.

REFERENCES

1. Mahumad Sharif Nizam, "Concentrates on combination on Rice Husk fiery debris and lime Stone" PhD Program, Institute of Chemistry, University of Punjab, Lahore, Pakistan: 1993.
2. Arnon Chaipanich, "Silica Fume: It's Role in Cement and Concrete Technology" Department of Physics, Faculty of Science, Thailand Research Foundation, Chiang Mai University, Chiang Mai 50200, Thailand.
3. D.L. Venkatesh Babu and S.C. Natesan, "Some examination on silica fume concrete", The Indian Concrete Journal, September 2004.
4. J.K. Dattatreya, M. Neelamegam and N.P. Rajamane, "A Comparison of impacts of ultra-fine fly fiery remains and silica fume in concrete", The Indian Concrete Journal, February 2006.
5. Ashok Tiwari and Ijiyas Momin, "Enhancing early-age quality of PSC with indigenous silica fume", The Indian Concrete Journal, October 2000.
6. H. Katkhuda, B. Hanayneh and N. Shatarat, "Influence of Silica Fume on High Strength Lightweight Concrete". World Academy of Science, Engineering and Technology 2009.
7. Suresh Kumar K.S, "Concentrates on Silica fume Concrete for Pavement Overlays" M-tech proposal (TEM) N.I.T. Tiruchirappalli.
8. Swamy R. N. what's more, Neville A. M, "Silica fume in concrete detail" endorsed, allowed or discarded Concrete International, March 2001, pp.73-77.
9. Detwiler R and Mehta P. K. 1989, "Silica fume supposedly causes a balancing out impact on concrete" cement and concrete research, vol 78(3), pp 345-352.
10. Joshi N. G. 2001, "Bandra – Worli ocean connect: Evolution of HPC blends containing Silica Fume", The Indian Concrete Journal, October 2001.
11. Kyayat K.H and Aictin.P.C, "Silica fume in concrete – A diagram" ACI SP-132, VOL.2, 1992, pp 44-52.
12. Alireza Naji Givi, Suraya Abdul Rashid, Farah Nora A. Aziz, Mohamad Amran Mohd Salleh, "Commitment of Rice Husk Ash to the Properties of Mortar and Concrete: A Review". Diary of American Science 2010.
13. G.A. Habeeb, M.M. Fayyadh, "Rice Husk Ash Concrete: the Effect of RHA Average Particle Size on Mechanical Properties and Drying Shrinkage ". Australian Journal of Basic and Applied Sciences, 3(3): 1616-1622, 2009.
14. Muhammad Harunur Rashid, M.D. Keramat Ali Molla and Tariffs Uddin Ahmed, "Mortar joining rice husk ash: strength and porosity". European Journal of Scientific Research ISSN 1450-216X Vol.40 No.3 (2010), pp.471-477 Euro Journals Publishing, Inc. 2010.
15. Dao Van Dong, Pham Duy Huu, Nguyen Ngoc Lan, "Impact of Rice Husk Ash on Properties of High Strength Concrete". The third ACF International Conference-ACF/VCA 2008.
16. Satakhun Detphan and Prinya Chindaprasirt, "Initial examination on synthetics open-field consuming rice husk powder: making geopolymer mortar for maintainable advancement in the country zone". Innovation and Innovation for Sustainable Development Conference (TISD2008) 28-29 January 2008.
17. Mauro M. Tashima, Carlos A.R. Silva, Jorge L. Akasaki and Michele Barbosa, "Influence of rice husk fiery remains in mechanical attributes of concrete ", IV International ACI/CANMET gathering on nature of concrete structures and late advances in concrete materials and testing Paper XII.08-p, 780-790.
18. Sumrerng Rukzon, Prinya Chindaprasirt, and Rattana Mahachai "Impact of crushing on synthetic and physical properties of rice husk fiery remains". Worldwide Journal of Minerals, Metallurgy and Materials Volume 16, Number 2, April 2009, Page 242.
19. J. James and M.S. Rao American Ceramic culture, Bulltein - 65(1986), P117-B80.
20. S. Antiohos and S. Tsimas, " Activation of fly cinder cementitious frameworks within the sight of quicklime Part I. Compressive quality and pozzolanic response rate". Cement and Concrete Research 34 (2004) 769–779.
21. Jiping Bai and Albinas Gailius, " Consistency of Fly Ash and Metakaoline Concrete". Diary of Civil Engineering and Management 2009 15(2): 131–135.
22. Anurag Misra, Rohit Ramteke and Madan Lal Bairwa, "Concentrate on Strength and Sorptivity Characteristics of Fly Ash Concrete", VOL. 2, NO. 5, October 2007 ISSN 1819-6608 ARPJ Journal of Engineering and Applied Sciences.
23. A. Sadr Momtazi, M. M. Ranjbar, F. Balalaei and R. Nemati, "The impact of Iran's Metakaoline in improving the concrete compressive quality". College of Guilan.
24. Bun Kim Ngun, Hasmaliza Mohamad, Etsuo Sakai and Zainal Arifin Ahmad, "Impact of rice husk powder and silica fume in ternary framework on the properties of mixed cement glue and concrete", Journal of Ceramic Processing Research. Vol. 11, No. 3, pp. 311~315 (2010).

Books of references:

- M.S Shetty, "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd, New Delhi.
- Krishna Raju, "Design of concrete mixes", 4th edition, CBS publishers and Distributors. New Delhi, India.
- Concrete and Highway Materials Lab Manual, Dayananada Sagar College of Engineering, Bangalore



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Reference codes of practice:

- IS: 456-2000, "Code of practice for plain and reinforced concrete".
- SP: 23-1982, "Hand book on concrete mixes (Based on Indian standards)".
- IS: 10262-2009, Indian standards, "recommended guidelines for concrete mix design" IS: 516-1959, Indian standards, "Methods of tests for strength of concrete".
- IS: 12269-1987, "Specifications for 53 Grade Ordinary Portland Cement".
- IS: 383 – 1970, "Specifications for Coarse and Fine Aggregates From Natural Sources for Concrete".
- IS: 4031(Part 6) -1988, "Determination of compressive strength of hydraulic cement other than masonry cement".