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COMPERATIVE STUDY OF DURABILITY OF CONCRETE MADE BY USING CALCAREOUS WASTE (SILICS FUME, RICE HUSK, SUGARCANE BAGASSE ASH)

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ABSTRACT
The general prospective on this paper is to consider the strength and durability of concrete replacing cement by different percentage with different mineral admixtures. Use of different strengthing cementitious material significant influences Fresh and Harden properties of concrete.This examination assists the impact of residual of sugarcane bagasse ash and Rice Husk Ash remains in the mechanical properties of concrete and strength. The fundamental design was to enhance the sugarcane bagasse ash, Silica fume (SCBA) and Rice Husk Ash (RHA) content toward Acid attack & Alkli attack of concrete to look at durability. Trials were estimating workability, compressive strength, Split tensile strength and weight reduction of concrete cube ina sulphuric acid (acid) & sodium Hydroxide (alkali) soaking environment.

Keywords: Admixture, Sugarcane bagasse ash, Ricehusk ash, Silica fume ash, Workability, Acid attack, Alkali attack.

1 Introduction

Sulfuric acid & Sodium Hydroxide solution in sewage, waste water treatment plantsand natural aquifer disintegrates concrete structures by reacting with cement hydrates. Concrete is certifiably not a chemically steady material in acidic climate. Portland cement regularly doesn't have great protection from acids. Some weak acids, might be endured if the exposure is mild or for less time. Durability of concrete might be characterized as the capacity of concreteto oppose weathering action, chemical attack and abrasion while keeping up its ideal engineering properties.

For quite a while, concrete was viewed as truly durable material requiring nearly zero maintenance. The assumption that is generally true except, when it is exposed to highly aggressive environment. We fabricate concrete designs in exceptionally polluted urban and industrial zones aggressive marine conditions, harmful sub-soil water in seaside zone and numerous of the run favorable conditions. Since the utilization of concrete lately, have spread to profoundly unforgiving and antagonistic conditions, the previous impression that concrete is a truly durable material is being undermined, especially by virtue of premature failures of numberof constructions in the recent past.

2 LITERATURE REVIEW

It covers exhaustive review of the work done by the researchers earlier on the wastes materials {Rice Husk Ash (RHA), Sugar-cane Bagasse Ash (SCBA) and Silica Fume (SF)}for utilizing them into the cement concrete. All these related information has been summarized and existing gaps in the field has been identified and presented under the following heads.

D. S. Ray et,al: 2019; They summarized the ongoing researches about the experimental investigation on the use of sugarcane bagasse ash in the construction of low volume traffic roads. The main focus of this research was to improve the transport industry so as to result in greater economy and mobility of goods and services by developing economic roads and also to utilize the various agro-wastes in the construction industry to result in suitable waste management for environmental susceptibility and eco-conservation.

Prof. Sonali Nawkhare et,al 2018; The compressive strength of concrete blocks containing Portland pozzolana cement with sugarcane bagasse ash at 5%, 10%, 15% and 20% replacement were investigated. The compressive strength was evaluatedfor 7, 14, and 28 days of curing period. The effects of SCBA % curing period, mix ratio on concrete block compressive strength, were studied and results are incorporated in the paper. The test results shows that sugarcane bagasse ash (SCBA) can be used as a partial replacement of cement upto 10% by weight of cement without any major loss in strength.

Parisa Setayesh Gar et,al: 2017: The results show that the SCBA sample had a grain size distribution very similar to that of the Type GU Portland cement used in this study. X-ray florescence revealed that this ash was chiefly composed of SiO2 (70%). At room temperature, the compressive strength of concrete increased till up to 10% SCBA incorporation. Even at 15%cementsubstitution, it matched that of the reference mix containing Portland cement alone.

Fapohunda Christopher et,al 2017; They investigated in order to arrest the incidence of global warming brought about by the emissions of greenhouse gases notably CO2 into the atmosphere, the use of materials that can substitute the material responsible for greenhouse gases is being promoted world-wide. Some of the finding are: (i) controlled incineration is required to produce RHA with the structure that can result in structural concrete. (ii) The use ofRHA resulted in increased water demand. (iii) Upto 10% cement replacement with RHAwill result in strength development comparable to the control specimens, and (iv) The use of RHA in concrete result in impervious RHA concrete microstructure to agent of degradation like, sulfate attacks, chloride ingress, etc., as well as good shrinkage properties, and thus produce durable concrete when used.

Seyed Alireza Zareei et,al 2017; This paper presents benefits resulted from various ratios of rice husk ash (RHA) on concrete indicators through 5 mixtures plans with proportions of 5,10, 15,20 and 25% RHA by weight of cement in addition to 10% micro- silica (MS) to be compared with a reference mixturewith 100% Portland cement. Tests results indicated the positive relationships between 15% replacement of RHA with increase in comprehensive strengths by about 20%, beyond that is associated with slight decrease in strength by about 20%. The optimum level of strength and durability properties generally gain with addition up to 20%, beyond that is associated with slight decrease in strength parameters by about 4.5%. M Vijaya Sekhar Reddy et, al 2013; It is observed from the results the maximum percentage loss in weight and percentage reduction in compressive strength due to Acids for M40 grade concrete are 1.25%, 16% with replacement of 10% Metakaoline and the minimum percentage loss in weight and strength are 1.18%, 14.9% with Replacement of 20% Fly ash. There is considerable variation in loss of weight andstrength only with Silica Fume replacement.(durability aspect of concrete).

Mahmud Amin et, al 2017; Considering the high concentrationof sulfuric acid solution, period of exposure, testing methods, and the material types as wellas proportions used The damage manifestations of concrete were represented by whitepowdery material deposited progressively on the surface of all specimens, exposedaggregates and uneven 88 surfaces. Concrete specimens made fromthe quaternary binder containing GU, fly ash, silica fume and nano-silica (GUFSFNS)had the highest mass loss of 29% in the GU group, while specimens made from thebinary binder comprising GU and fly ash (GUF) had the lowest total mass loss of18%. Correspondingly, the counterpart specimens from the PLC group had masslosses of 26% (PLCFSFNS) and 20% (PLCF), respectively. The improvement in the acidic resistance of concrete was particularly observed for thebinary systems comprising 30% fly ash, which did not show the lowest penetrability.Therefore, the relationship between the penetrability of specimens and their total masslosses (surface degradation) after exposure to the sulfuric acid solutions was mixed.The degradation of concrete was mainly linked to the chemical nature of the cementitious paste at the exposed surface as shown by the mineralogical, thermal andmicroscopy analyses, which suggests that the approach of improving the physicalresistance of concrete to mitigate severe acidic attack should be reconsidered.

N. K. Amudhavalli et al 2012; The normal consistency increases about 40% when silica fume percentage increases from 0% to 20%. The optimum 7 and 28-day compressive strength and flexural strength have been obtained in the range of 10-15 % silica fume replacement level. Increase in split tensile strength beyond 10 % silica fume replacement is almost insignificant whereas gain in flexural

tensile strength have occurred even up to 15 % replacements. Silica fume seems to have a more pronounced effect on the flexural strength than the split tensile strength. When compared to other mix the loss in weight and compressive strength percentage was found to be reduced by 2.23 and 7.69 when the cement was replaced by 10% of Silica fume.
E. Hewayde, M.L. Nehdiet,al;(2017) find that the resistance of concrete made with Type 50E cement todegradation in an aggressive sulfuric acidic environment (7% and 3% H2SO4) wassimilar to that of concrete made with Type 10 cement. A dosage of 15% metakaolin also decreased the mass loss of concretespecimens due to immersion for 61 days in sulfuric acid solutions with concentrationsof 7% and 3% by 38% and 25%, respectively. The compressive strength atdifferent ages and porosity of concrete were slightly affected by using various levelsofOCI. However, OCI reduced the mass loss of concrete specimens due to 61 days ofimmersion in sulfuric acid solutions with concentrations of 7% and 3% by 12% and9%, respectively.
M Vijaya Sekhar Reddyet,al;(2013) It is observed from the results the maximum percentage loss in weight and percentage reduction in compressive strength due to Acids for M40 grade concrete are 1.25%, 16% with replacement of 10% Metakaoline and the minimum percentage loss in weight and strength are 1.18%, 14.9% with replacement of 20% Fly ash. There is considerable variation in loss of weight and strength only with Silica Fume replacement. Present investigation shows that the maximum percentage loss in weight and percentage reduction in compressive strength due to Alkalinity for M40 grade concrete are 1.5%, 19% with replacement of 10% Metakaoline and the minimum percentage loss in weight and strength are 1.36%, 16% with replacement 20% Fly ash. There is considerable variation in loss of weight and strength only with Silica Fume replacement. It is identified that the maximum percentage reduction in compressive strength due to sulfates of M40 grade concrete is 10.55% with replacement 20% Fly ash and the minimum percentage reduction in strength is 10.2% with 10% Metakaoline.
H. Rahmani, A.A. Ramazanianpour, T. Parhizkar et,al;. In this investigation the initial mass of samples was determined under saturated surface dry (SSD) conditions at the age of 28 days. Then, the specimens were immersed in sulfuric acid solutions. based on visual inspections and weight loss test results, it can be seen that the usage of silica fume and ultra fine filler may enhance the service life of concretes against high concentration of sulfuric acid solutions.

3 METHODOLOGY

In the work, M-20 grade concrete will be developed by replacing cement by 5%, 8%, 11%, 14%, 21% of environmental wastes Rice husk ash, Sugarcane Bagasse ash and Silica Fume.
Proportion

The concrete prepared for the experimental procedure is of M-20 grade nominal mix

Table 3.1 Concrete Mix Design (1 : 1.5 : 3).

S.No.	Replacement	Cement (perm^3)	Fine Aggregate (perm^3)	Coarse Aggregate (per m^3)	Water (perm^3)	Admixture + 1.25% superplasticizer
1	No replacement	516.67 Kg	808.356 Kg	1097.4 Kg	186Kg	0 kg
2	5% SF	490.84 Kg	808.356 Kg	1097.4 Kg	186Kg	25.83Kg
3	8% SF	475.34 Kg	808.356 Kg	1097.4 Kg	186Kg	41.33 Kg

4	11% SF	459.84kg	808.356 Kg	1097.4 Kg	186Kg	56.83Kg
5	14% SF	444.34kg	808.356 Kg	1097.4 Kg	186Kg	62.33Kg
6	17% SF	428.84 kg	808.356 Kg	1097.4 Kg	186Kg	87.83kg
7	21% SF	408.17Kg	808.356 Kg	1097.4 Kg	186Kg	108.50Kg
8	5% RHA	490.84 Kg	808.356 Kg	1097.4 Kg	186Kg	25.83Kg
9	8% RHA	475.34 Kg	808.356 Kg	1097.4 Kg	186Kg	41.33 Kg
10	11% RHA	459.84kg	808.356 Kg	1097.4 Kg	186Kg	56.83Kg
11	14% RHA	444.34kg	808.356 Kg	1097.4 Kg	186Kg	62.33Kg
12	17% RHA	428.84 kg	808.356 Kg	1097.4 Kg	186Kg	87.83kg
13	21% RHA	408.17Kg	808.356 Kg	1097.4 Kg	186Kg	108.50Kg
14	5% SCBA	490.84 Kg	808.356 Kg	1097.4 Kg	186Kg	25.83Kg
15	8% SCBA	475.34 Kg	808.356 Kg	1097.4 Kg	186Kg	41.33 Kg
16	11% SCBA	459.84kg	808.356 Kg	1097.4 Kg	186Kg	56.83Kg
17	14% SCBA	444.34kg	808.356 Kg	1097.4 Kg	186Kg	62.33Kg
18	17% SCBA	428.84 kg	808.356 Kg	1097.4 Kg	186Kg	87.83kg
19	21% SCBA	408.17Kg	808.356 Kg	1097.4 Kg	186Kg	108.50Kg

4 RESULTS AND DISCUSSION

4.1 Slump cone test

Table 4.1 Slump cone test Result

S.No	Remark	Slump Value(mm)	Type ofslump
1.	No Replacement	45 mm	Low
2.	5% Cement Replaced by SF	52 mm	Low
3.	8% Cement Replaced by SF	55 mm	Low
4.	11% Cement Replaced by SF	57 mm	Low
5.	14% Cement Replaced by SF	59 mm	Low

6.	17% Cement Replaced by SF	60 mm	Low
7.	21% Cement Replaced by SF	64 mm	Low
8.	5% Cement Replaced by RHA	81 mm	Medium
9.	8% Cement Replaced by RHA	77 mm	Medium
10.	11% Cement Replaced by RHA	75 mm	Medium
11.	14% Cement Replaced by RHA	73 mm	Medium
12.	17% Cement Replaced by RHA	72 mm	Medium
13.	21% Cement Replaced by RHA	70 mm	Low
14.	5% Cement Replaced by SCBA	75 mm	Low
15.	8% Cement Replaced by SCBA	78 mm	Medium
16.	11% Cement Replaced by SCBA	82 mm	Medium
17.	14% Cement Replaced by SCBA	88mm	Medium
18.	17% Cement Replaced by SCBA	88 mm	Medium
19.	21% Cement Replaced by SCBA	92mm	Medium

- The slump value was found in Sample 1 is 50 mm in which there was no replacement of cement, whereas the maximum value of slump was found in sample 6 (S6) in which the cement was replaced by 21 % Silica Fume, that is 64 mm.

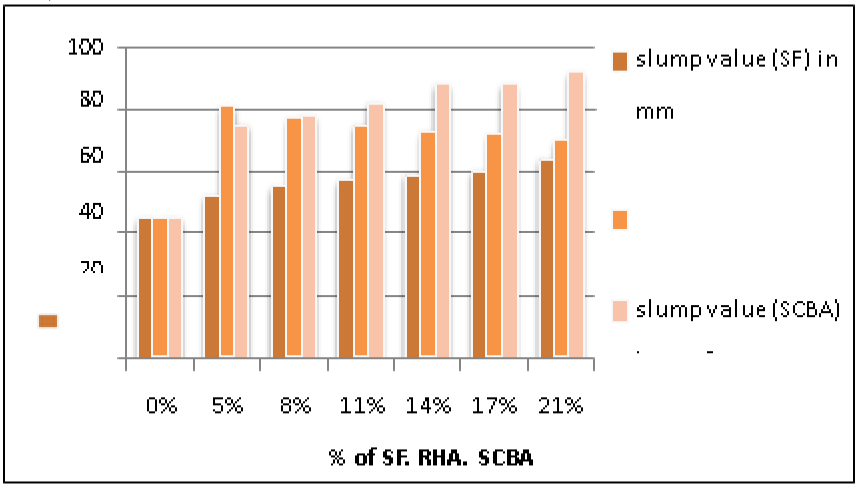

Figure 4.1 Workabilityresult

- The maximum value of slump was found in sample 8 (S8) in which the cement was replaced by 5 % Rice husk ash, that is 81 mm.
- The maximum value of slump was found in sample 19 (S19) in which the cement was replaced by 21 % Sugarcane bagasse, that is 92 mm.

4.2 Strength Test

Table 4.2 Compressive Strength Test Result at day 7

S.No	Remark	Compressive Strength (N/mm^2)
1.	No replacement	14.79
2.	5%Cement Replaced by SF	16.43
3.	8%CementReplaced by SF	18.6

4.	11%CementReplaced by SF	19.8
5.	14% Cement Replacement by SF	17.2
6.	17% Cement Replacement by SF	15.6
7.	21%Cement Replaced by SF	13.14
8.	5%Cement Replaced by RHA	20.5
9.	8%Cement Replaced by RHA	21.6
10.	11% Cement Replacement by RHA	20.1
11.	14% Cement Replacement by RHA	17.3
12.	17%Cement Replaced by RHA	16.8
13.	21%Cement Replaced by RHA	16.1
14.	5%Cement Replaced by SCBA	24.06
15.	8% Cement Replacement by SCBA	26.7
16.	11% Cement Replacement by SCBA	24.9
17.	14% Cement Replacement by SCBA	23.4
18.	17% Cement Replacement by SCBA	22.26
19.	21% Cement Replacement by SCBA	21.2

- It can be observed that the partial replacement of SF by cement the compressive strengthincreases upto11% of replacement of cement after that the strength will be decresed.
- & the partial replacement of RHA by cement the compressive strength increases upto 8% ofreplacement of cement after that the strength will be decresed
- & the partial replacement of SCBA by cement the compressive strength increases upto 14%of replacement of cement after that the strength will be decresed.

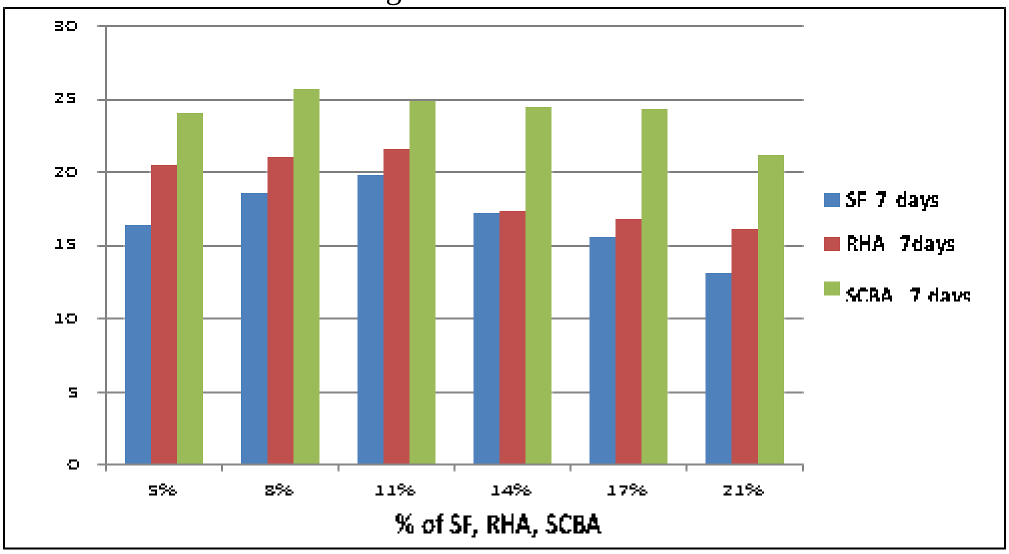

Figure 4.2 Strength test at 7 day (cement replaced by SF, RHA & SCBA)

Table 4.3 Compressive Strength Test Result at day 28

S. No.	**Remark**	**Compressive Strength (N/mm^2) Target Mean Strength**
1.	No replacement	26.61
2.	5% Cement Replaced by SF	30.38
3.	8% Cement Replaced by SF	31.49
4.	11% Cement Replaced by SF	32.96
5.	14% Cement Replaced by SF	28.8
6.	17% Cement Replaced by SF	25.9

7.	21% Cement Replaced by SF	24.62
8.	5% Cement Replaced by RHA	25.125
9.	8% Cement Replaced by RHA	26.5
10.	11% Cement Replaced by RHA	25.3
11.	14% Cement Replaced by RHA	24.5
12.	17% Cement Replaced by RHA	24.20
13.	21% Cement Replaced by RHA	22.49
14.	5% Cement Replaced by SCBA	33.01
15.	8% Cement Replaced by SCBA	34.2
16.	11% Cement Replaced by SCBA	35.56
17.	14% Cement Replaced by SCBA	33.78
18.	17% Cement Replaced by SCBA	32.01
19.	21% Cement Replaced by SCBA	30.93

- The maximum compression strength at the 28th day was 32.96 N/mm2 in which Cement replaced by 11% Silica Fume (SF).
- The maximum compression strength at the 28th day was found 26.5 N/mm2 in which Cement replaced by 8% Rice husk ash (RHA).
- The maximum compression strength at the 28th day was found 35.01 N/mm2 in which Cement replaced by 17% Sugarcane bagasse ash (SCBA),

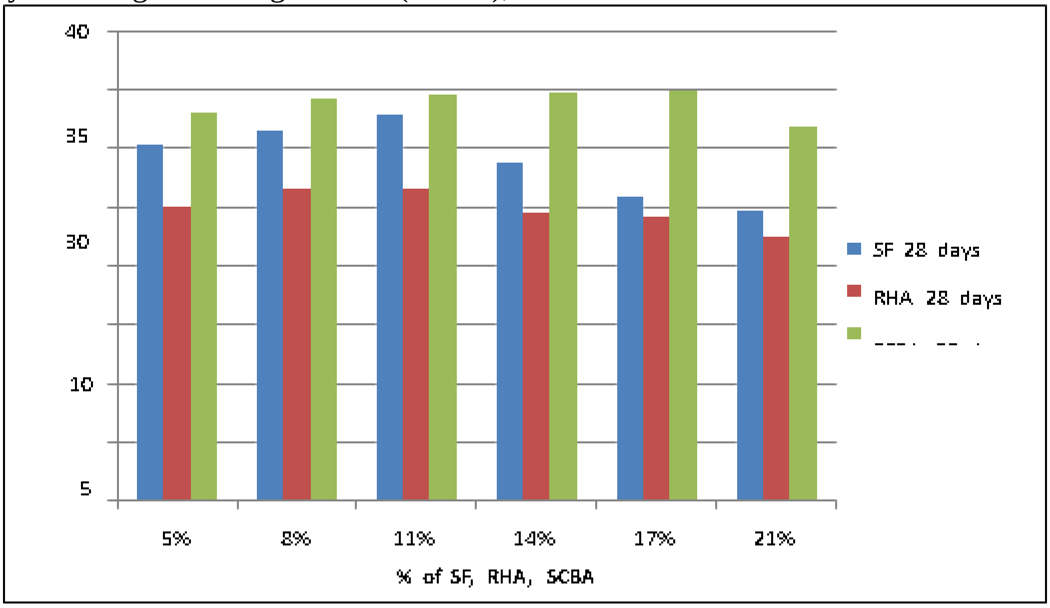

Figure 4.3 Strength test at 28 day (cement replaced by SF, RHA & SCBA) Table4 .3 Split Tensile Strength Test Result at day 7

S.No	**Remark**	**Split tensile Strength(N/mm^2)**
1	No replacement	15.4
2	5%Cement Replaced by SF	17.87
3	8%CementReplaced by SF	18.12
4	11%CementReplaced by SF	20.5
5	14% Cement Replacement by SF	21.5
6	17% Cement Replacement by SF	19.6
7	21%Cement Replaced by SF	16.5
8	5%Cement Replaced by RHA	20.44
9	8%Cement Replaced by RHA	21.0

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10	11% Cement Replacement by RHA	21.8
11	14% Cement Replacement by RHA	18.6
12	17%Cement Replaced by RHA	15.9
13	21%Cement Replaced by RHA	14.6
14	5%Cement Replaced by SCBA	20.78
15	8% Cement Replacement by SCBA	22.9
16	11% Cement Replacement by SCBA	24.9
17	14% Cement Replacement by SCBA	21.3
18	17% Cement Replacement by SCBA	18.4
19	21% Cement Replacement by SCBA	17.6

Maximum and Minimum values of split tensile strength-

- The maximum & minimum value of split tensile strength is 21.5 N/mm2 (cement replaced by14% of SF) & 16.5 N/mm2 (cement replaced by 21% of SF).
- The maximum & minimum value of split tensile strength is 21.8 N/mm2 (cement replaced by11% of RHA) & 14.6 N/mm2 (cement replaced by 21% of RHA).
- The maximum & minimum value of split tensile strength is 24.9 N/mm2 (cement replaced by11% of SCBA) & 17.6 N/mm2 (cement replaced by 21% of SCBA).
- The cement replaced by rice husk ash (RHA), Sugarcane Bagasse Ash (SCBA) and Silica Fume(SF) can be used for High-performance Concrete, Insulators, Green concrete, Bathroom floors, Industrial factory floorings, Concreting the foundation, Swimming.

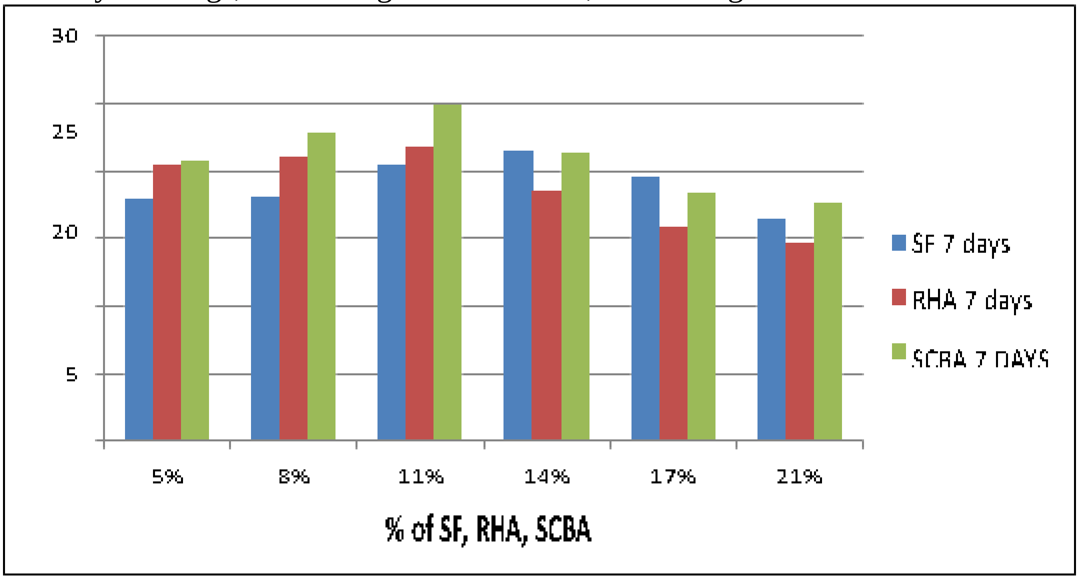

Figure 4.4 Strength test at 7 day (cement replaced by SF, RHA & SCBA) Table 4.5 Split Tensile Strength Test Result at day 28

S.No	**Remark**	**Split tensile Strength(N/mm^2)**
1	No replacement	24.3
2	5%Cement Replaced by SF	25.42
3	8%CementReplaced by SF	26.5
4	11%CementReplaced by SF	27.1
5	14% Cement Replacement by SF	27.8
6	17% Cement Replacement by SF	25.4
7	21%Cement Replaced by SF	24.6
8	5%Cement Replaced by RHA	26.2

9	8%Cement Replaced by RHA	25.9
10	11% Cement Replacement by RHA	21.2
11	14% Cement Replacement by RHA	19.6
12	17%Cement Replaced by RHA	15.9
13	21%Cement Replaced by RHA	14.6
14	5%Cement Replaced by SCBA	27.6
15	8% Cement Replacement by SCBA	30.8
16	11% Cement Replacement by SCBA	32.9
17	14% Cement Replacement by SCBA	28.6
18	17% Cement Replacement by SCBA	27.5
19	21% Cement Replacement by SCBA	22.4

Maximum and Minimum values of split tensile strength-

- The maximum value was found 27.8 N/mm2 (cement replaced by 14% of SF). The minimumvalue was found 24.6 N/mm2 (cement replaced by 21% of SF).
- The maximum value was found 26.2 N/mm2 (cement replaced by 5% of RHA). The minimumvalue was found 14.6 N/mm2 (cement replaced by 21% of RHA).
- The maximum value was found 32.9 N/mm2 (cement replaced by 11% of SCBA). The minimum value was found 22.4 N/mm2 (cement replaced by 21% of SCBA).
- The value of Tensile strength at the 28th day was found in the sample 1 is 24.3 N/mm2.

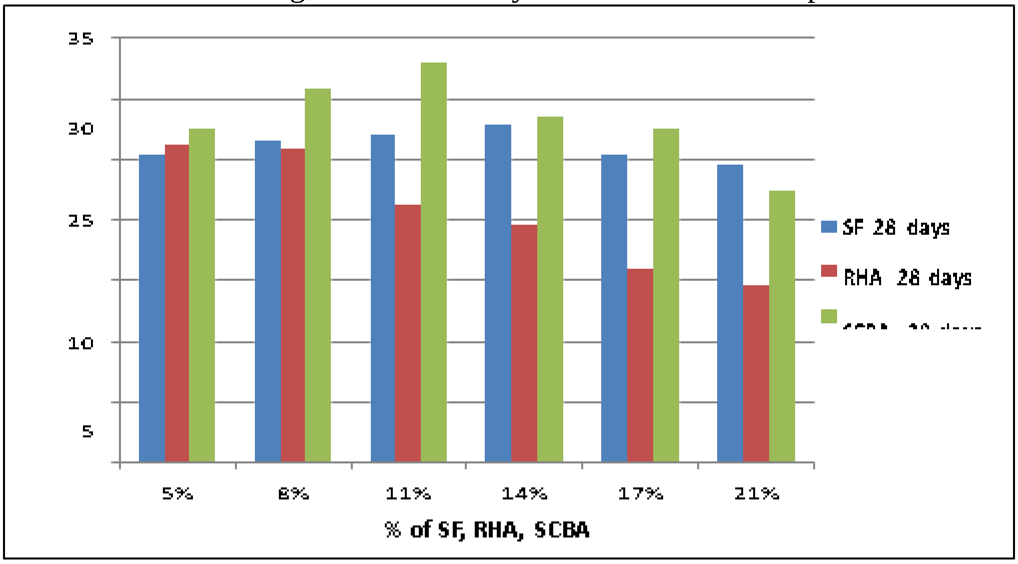

Figure 4.5 Strength test at 28 day (cement replaced by SF, RHA & SCBA)

4.3 Durability Test (Acid & Alkali Test)

Table 4.6 Acid test result (in kg)

Specimen	**Cube Weight Before Acid**	**Cube Weight After Acid**	**Loss Of Weight**	**% of weight reduction**
Conventional Concrete	8.7	8.3	0.4	3.4%
SF5	8.9	8.6	0.3	2.67%
SF8	9.8	9.6	0.2	1.96%
SF11	9.3	9.1	0.2	1.86%
SF14	9.5	9.2	0.3	2.8%
SF17	9.8	9.5	0.3	3%
SF21	9.8	9.4	0.4	4%
RHA5	9.3	9.0	0.3	2.8%

RHA8	9.8	9.6	0.2	1.96%
RHA11	9.9	9.7	0.2	1.98%
RHA14	9.3	9	0.3	2.79%
RHA17	8.9	8.5	0.4	3.56%
RHA21	10	9.6	0.4	4%
SCBA5	9.6	9.3	0.3	2.8%
SCBA8	9.5	9.3	0.2	2%
SCBA11	9.4	9.2	0.2	1.92%
SCBA14	9.8	9.6	0.2	1.96%
SCBA17	9.6	9.3	0.3	2.88%
SCBA21	9.8	9.4	0.4	3.92%

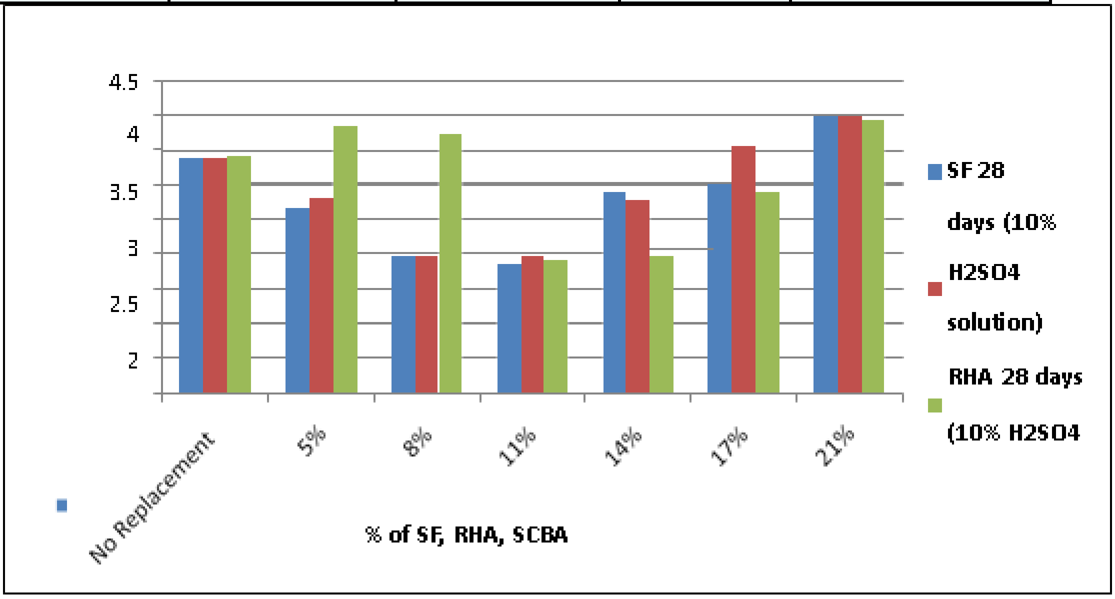

Figure 4.6 Weight reduction at 28 day (Cement replaced by SF, RHA &SCBA) 10% H2SO4 solution

- The Addition of 11% SF, 8% RHA,14% SCBA shows higher resistance against sulfate attackfor continues soaking environment.
- If we increase or decrease the % of admixtures (SF, RHA & SCBA) in concrete, then it will lessresist against sulfate attack.

Table4.7 Alkali test result (in kg)

Specimen	Cube Weight Before Alkali	Cube Weight After Alkali	Loss Of Weight	% of weight reduction
Conventional Concrete	8.7	8.3	0.4	3.4%
SF5	8.8	8.5	0.3	2.64%
SF8	9.7	9.5	0.2	1.94%
SF11	9.7	9.3	0.3	0.98%
SF14	9.9	9.7	0.2	1.98%
SF17	9.9	9.6	0.3	2.97%
SF21	9.9	9.5	0.3	3.9%
RHA5	9.3	9	0.3	2.79%

RHA8	9.8	9.6	0.2	1.96%
RHA11	9.9	9.7	0.2	1.98%
RHA14	9.3	9	0.3	2.79%
RHA17	9.4	9.1	0.3	2.82%
RHA21	9.6	9.2	0.4	3.8%
SCBA5	9.6	9.3	0.3	2.88%
SCBA8	9.7	9.5	0.2	1.94%
SCBA11	9.4	9.2	0.2	1.5%
SCBA14	9.8	9.7	0.1	0.98%
SCBA17	9.4	9.3	0.2	1.92%
SCBA21	9.8	9.5	0.3	2.94%

- The Addition of 11% SF, 8% RHA,14% SCBA shows higher resistance against alkali attack forcontinues soaking environment.
- If we increase or decrease the % of admixtures (SF, RHA & SCBA) in concrete, then it will lessresist against alkali attack.

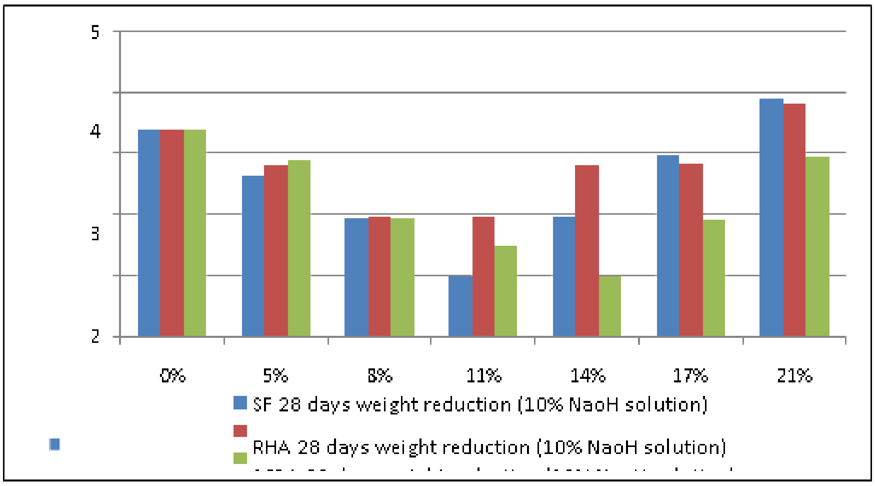

Figure 4.7 Weight reduction at 28 day (Cement replaced by SF, RHA & SCBA)

5 Conclusion

5.1 Slump cone Test

Slump Cone Values lies between the ranges of 45 to90 mm, hence concrete mix are suitable for R.C.C. work.

- It can be observed that, if we increase the amount of admixtures then the workability also increased.
- The slump value was found 45 mm in which there was no replacement of cement, whereas the maximum value of slump was found in which the cement was replaced by 21 % Silica Fume, that is 64 mm.
- It can be observed that the slump value is decreased when the % of Rice husk ash is increased. The maximum value of slump was found in which the cement was replaced by 5 % Rice husk ash that is 81 mm.
- The maximum value of slump was found in which the cement was replaced by 21 % Sugarcane bagasse, that is 92 mm.
- It can be observed that the slump value is increased when the % of Sugarcane bagasse ash is increased.

5.2 Compressive Strength

- The maximum compression strength at the 28th day was found that is 32.96 N/mm2 in which Cement replaced by 11% Silica Fume (SF), 26.5 N/mm2 in which Cement replaced by 8% Rice husk ash (RHA), 35.01 N/mm2 in which Cement replaced by 17%
Sugarcane bagasse ash (SCBA).
- The concrete mix other than the sample S7, S8, S14 are found to be fit for use in the different construction purposes as per the suitability, as they passed to attain the standard strength as per the M-20 grade of concrete and referral concrete sample.

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5.3 Split Tensile Strength

- The maximum value of split tensile strength at the 28th day was found 27.8 N/mm2 (cement replaced by 14% of SF), 26.2 N/mm2 (cement replaced by 5% RHA), 32.9 N/mm2 (cement replaced by 11% of SCBA).
- The value of Tensile strength at the 28th day was found 24.3 N/mm2 without admixture.

5.4 Durability Test (Acid & Alkali Test)

- If we increase or decrease the % of admixtures (SF, RHA & SCBA) in concrete, then it will less resist against sulfate attack. 11% SF, 8% RHA,14% SCBA shows higher resistance against sulfate attack for continues soaking environment.
- If we increase or decrease the % of admixtures (SF, RHA & SCBA) in concrete, then it will less resist against alkali attack. 11% SF, 8% RHA, 14% SCBA shows higher resistance against alkali attack for continues soaking environment.

5.2 Future work

- The Experimental work can be done by various other proportions and ratios of admixtures inthe concrete mix design.
- The experimental investigation of basic properties of concrete is done on 7 & 28days, further it can be done for longer period i.e. 56, 90, and 180 days.
- The experiment can be done with different water cement ratios in future.
- The experiment can be done using other wastes present in the environment which are needed to be disposed off containing cementitious properties.

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