STUDY OF PROPERTIES OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH SUGARCANE BAGASSE ASH

A Thesis

Submitted in partial fulfillment of the requirements for the award of the degree of

MASTER OF TECHNOLOGY

IN

CIVIL ENGINEERING

With specialization in

Structural Engineering

Under the supervision of

Mr. Abhilash Shukla
(Assistant Professor)

BY

Sheel Mohan
162659

TO

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

WAKNAGHAT, SOLAN – 173234

HIMACHAL PRADESH, INDIA

May-2018

CERTIFICATE

This is to certify that the work which is being presented in the thesis titled **"STUDY OF PROPERTIES OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH SUGARCANE BAGASSE ASH"** in partial fulfillment of the requirements for the award of the degree of Master of Technology in Civil Engineering with specialization in "**Structural Engineering**" and submitted to the Department of Civil Engineering, **Jaypee University of Information Technology, Waknaghat** is an authentic record of work carried out by Sheel Mohan (162659) during a period from July 2017 to May 2018 under the supervision of **Mr. Abhilash Shukla (Assistant Professor),** Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat.

The above statement made is correct to the best of our knowledge.

Date:

Dr. Ashok Kumar Gupta	Mr. Abhilash Shukla	External Examiner
Professor & Head of Department	Assistant Professor	
Department of Civil Engineering	Department of Civil Engineering	
JUIT Waknaghat	JUIT Waknaghat	

ACKNOWLEDGEMENT

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals. I would like to extend my sincere thanks to all of them.

I am highly indebted to my guide Mr. Abhilash Shukla for his guidance and constant supervision as well as for providing necessary information regarding the project & for his support in the project. He has been a true motivation throughout and helped me in exploring various horizons of this project. Without his guidance, this project would not have been possible.

My thanks and appreciations go to civil department in developing the project and people who have willingly helped me out with their abilities. I would also like to thank my colleagues for their co-operation in framing the project.

I would like to thank my parents for their continuous support and motivation. Finally, I would like to thank to all who directly or indirectly helped me.

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LIST OF ABBREVIATION

W/CM	Water to Cementitious material ratio
W/B	Water Binder ratio
SCBA	Sugarcane bagasse powder
CER	Certified emission reduction
SF	Silica Fume
SP	Superplasticizer
RHA	Rice Husk Ash
CDM	Clean Development Mechanism

ABSTRACT

This paper introduce the concept on high performance of concrete of cement using sugarcane bagasse ash (SCBA) in replace of cement with different percentage value. Sugarcane bagasse ash, fly ash, glass used as mineral intermixtures in Portland cement to improve the tensile strength, compressive strength, flexural strength of concrete by replacing of cement. As we noticed, use of Portland cement is very common in all type of construction, if construction increases the availability of Portland cement also increases, so we are consuming the natural materials to replace it by cement. It can also cause environmental advantages like minimizing in energy consumption or in greenhouse gas emissions and decrease of waste emissions. We also reduce carbon dioxide (CO_2) emissions with these admixtures. Consequently, sugarcane bagasse powder (SCBA) can be utilized as mineral admixture because of high silica (SiO2) content. In this experimental study, we reduced cement ratio and used sugarcane bagasse ash (SCBA) with 0%, 5%, 10%, 15%, 20%, 25%, 30%, 35%. The indicates that the SCBA had highly flexural strength, compressive strength and split tensile strength as compare to normal concrete. The outcomes demonstrates that Sugarcane Bagasse gives increment in the workability of concrete when contrasted with conventional cement. The outcomes shows that SBA can be utilized 15% substitution as compared to normal concrete.

CHAPTER 1: INTRODUCTION

1.1. GENERAL

It is well known that mineral intermixtures are very effectively implement as harmonious materials in Portland cement. Rise husk ash, sugarcane bagasse used as mineral intermixtures in Portland cement to improve the, tensile strength, compressive strength, flexural strength of concrete by replacing of cement or sand. Portland cement is being used extensively for almost every construction. Each structure has its particular needs, so Portland cement requires some change in the properties to meet these needs. The broad research on concrete demonstrates that mineral admixture to be utilized as concrete substitution to expand workability. As we noticed, use of Portland cement is very common in all type of construction, If construction increases the availability of Portland cement also increases, so we are consuming the natural materials to replace it by cement.

1.2. PROJECT SPECIFIC

If we are successfully, replace it by cement the cost of concrete also reduced. It can also cause environmental advantages like minimizing in energy consumption or in greenhouse gas emissions and decrease of waste emissions. We also reduce carbon dioxide (CO_2) emissions with these admixtures. Sugarcane bagasse ash (SCBA) can be utilized as mineral admixture because of its high percentage of silica (SiO2). Cement containing ground bagasse ash includes different tests compressive strength, split tensile strength, flexural strength. Sugarcane bagasse ash (SCBA) is the most extensively material used in place of cement. Brazil is the no.1 country in the world to be known for producing sugarcane at large number of scale, which at 720 million tons grows over 40% of world crop. In India Uttar Pradesh, Maharashtra and Karnataka are three largest states in India. India's 2017-2018 sugar production likely to touch 30 million tons. One ton of burned bagasse ash produce 25 kg of ash. Fineness modulus of bagasse ash is 0.6 to 1.2mm.

This paper presents a study on high performance of concrete of cement using sugarcane bagasse ash (SCBA) in replace of cement with different percentage value. Sugarcane bagasse ash used as mineral intermixture in Portland cement to improve the tensile strength, compressive strength flexural strength of concrete by replacing it by cement. As we noticed, use of Portland cement is very common in all type of construction, if construction increases the availability of Portland cement also increases, so we are consuming the natural materials to replace it by cement. Sugarcane bagasse ash (SCBA) is produced in sugar mills. It is one of the pozzolanic materials that is widely used.

We also reduce carbon dioxide (CO_2) emissions with this admixture. It is also noticed that 2.5% total waste of world is generated by manufacturing of cement from industrial origins. It can be replaced by weight of cement in concrete at that point cost could be diminished without influencing its strength. Consequently, sugarcane bagasse ash (SCBA) can be utilized as mineral admixture because of its high percentage of silica (SiO2). The way that the greater part of the exploration on SCBA has concentrated on its utilization it is used as a supplementary material in concrete, there is an awesome potential for its utilization in different applications. A portion on the major discovery demonstrates that its utilization as bond substitution is beneficial straightaway.

Sugarcane bagasse ash (SCBA) is the most extensively material used in place of cement. Brazil is the no.1 country in the world to be known for producing sugarcane at large number of scale, which at 720 million tons grows over 40% of world crop. After Brazil, India is the second largest production of sugarcane in the world. Uttar Pradesh, Maharashtra and Karnataka are three largest states in India. India's 2017-2018 sugar production likely to touch 30 million tons. One ton of burned bagasse ash produce 25 kg of ash. Fineness modulus of bagasse ash is 0.6 to 1.2mm.

With expanding interest and utilization of concrete, analysts and researcher are looking for eco-friendly and contribute towards for better use. In this topic SCBA has been artificially and physically described and successfully replace with the proportion of 0% to 35% by weight of cement in concrete. The present examination was completed on SCBA in replace of Portland cement. Which was obtained from Chandigarh in India. In this experiment we decrease the weight of cement by 0 to 35% and replace it by sugarcane bagasse ash respectively.

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Figure–1 Sugarcane bagasse ash

It shows that up to 20% of conventional Portland cement can be replaced with well-consumed bagasse ash remains with eco-friendly impact on the alluring properties of concrete, for example, the improvement of split tensile strength, high early strength and decreased water penetrability, decreased chloride infiltration, all of which have a direct bearing on the solid structures. For example, high temperature fragmented burning that occur in the mills, and its impact on the reactivity of SCBA. These components influence the level of crystallinity of the silica in the bagasse ash, and the nearness of contaminations, for example, carbon and its emissions. Such properties could restrain the contact between Calcium Hydroxide (CH) and receptive silica and keep them from framing stable mixes.

Keeping in mind the end goal is to deliver SCBA with pozzolanic content, which will give undefined silica, low carbon substance and controlling the temperature.

Decrease of molecule size of SCBA by granulating likewise has a critical impact on the pozzolanic action. The substitution of cement with a ultrafine, ground SCBA, delivered by vibrating granulating, takes into consideration the generation of superior cement with the same mechanical reaction as the solid arranged exclusively utilizing Portland bond.

In rundown, SCBA is a pozzolanic that can mostly replace clinker in concrete and thusly, its utilization have a tendency to lessen emanations of CO_2 into the air. SCBA is an agro-modern buildup accessible in a few nations.

The mix of lime in addition to sieved SCBA, lime and cement were utilized as a part of the adjustment of compacted cubes. The tests were tried for flexural, compressive strength and split tensile strength. At long last, vitality utilization, CO_2 emanations furthermore, vitality in transportation of the materials were assessed.

It ought to be noticed that the molecule state of bagasse slag is totally not the same as that of fly ash. It has been accounted for that supple particles are related with incompletely consumed pieces of coal (carbon) coming about because of fragmented ignition.

The outcomes demonstrated that, at 28 days, the casted cubes containing 0– 35% ground bagasse ash remains by weight of fastener had more prominent compressive strength than the control concrete, while the water penetrability is lower than the control concrete. Concrete containing 15% ground bagasse slag had the most astounding compressive strength. Water porousness of cement diminished as the fragmentary substitution of ground bagasse slag was expanded. For the heat advancement, the most extreme temperature ascent of cement containing ground bagasse ash was lower than the normal concrete. The outcomes show that ground bagasse ash can be utilized as a pozzolanic material in concrete with a worth strength, bring down heat development, and diminished water porousness as for the control concrete.

1.3. OBJECTIVES

- To accomplish that the SCBA had highly strength for flexural, compressive and split tensile as compare to normal concrete.
- To accomplish that the Sugarcane Bagasse gives increment in the workability of concrete when contrasted with conventional cement.
- Reduce the cost of concrete.

CHAPTER 2: LITERATURE REVIEW

All the research paper study about

- Reducing the cost of concrete
- Increase the flexural strength, compressive strength, split tensile strength using SBA
- Particle packaging of concrete
- Reduce of carbon contents in cement

2.1. Girge et al. 2013(6) presents that admixtures that are ecofriendly and contribute towards for better advancement. Use of mechanical and rural waste created by modern procedures has been the attention on environment pollution that is less with the use of SBA. One of the agro squander sugar cane bagasse ash (SCBA) remains which is a waste item got from sugar processes. Juice is separated from sugar cane at that point ash created by consuming bagasse in uncontrolled condition and at high temperature.

In this paper SCBA has been synthetically and physically portrayed and halfway supplanted in the proportion of 0% to 30% by weight of bond in concrete.

The properties for SBA content are tried like split tensile strength and for solidified cement compressive strength at 7, 28, 56 and 90 days. The outcomes show that the strength of concrete increment up to 15% SCBA substitution with cement.

Advantage

- SCBA concrete had essentially higher compressive strength as compared to normal concrete. It is discovered that the bond could be profitably replaced with SCBA up to most extreme point.
- Incomplete substitution of bond by SCBA expands workability of new concrete; along these lines utilization of super plasticizer isn't fundamental.

Disadvantage

- No brief explanation of durability, permeability of concrete.
- Reduce of cost is not mentioned.
- Particle packaging not described.

2.2. Chusilp et al. 2009(16) generalized that the physical properties of cement containing SBA includes compressive strength, water penetrability and heat evolution were explored. Bagasse ash obtained from a sugar industry. It is utilized as a type A Portland concrete at 10 to 30wt% of cover. The water to fastener proportion and cover substance of the concrete was held steady.

The outcomes demonstrated that, at 28 years old days, concrete containing 10 to 30% ground bagasse ash by weight of cement had more noteworthy compressive strength than the normal concrete, water penetrability was lower than the control concrete. Concrete containing 20% SBA had the most astounding compressive strength at 113% of the normal concrete.
Water penetrability of cement diminished as the partial substitution of SBA was expanded. For the heat advancement, the most extreme temperature ascent of cement containing SBA was lower than the normal concrete. It was discovered that the greatest temperature ascent of the solid was decreased as contrasted and the control concrete when the concrete was supplanted by SBA at 10 to 30 wt% of fastener, individually. The outcomes show that SBA can be utilized as a pozzolanic material in concrete with a worthy quality, bring down heat advancement, and decreased water porousness regarding the control concrete.

Advantages

- Concrete containing SBA had higher compressive strength and a lower water porousness than the control concrete at the age of 28 and 90 days.
- The greatest temperature ascent of cement containing 10– 30% ground bagasse ash remains lower than the control concrete. The bond substitution portion by ground bagasse was expanded, the comparing temperature ascend in concrete.

Disadvantage

- Reduce of cost is not mentioned.
- Not define the flexural strength and split tensile strength.

2.3. Thangavel et al. 2007(19) presents the usage of waste materials in solid produce gives a palatable answer for a portion of the natural concerns and issues related with squander administration. Agro squanders, for example, rice husk ash, wheat ash, SBA are utilized as pozzolanic materials for the advancement of mixed concretes. Barely any investigations have been accounted for on the utilization of SBA as halfway concrete substitution material in regard of bond mortars. The impacts of SBA content as halfway substitution of bond on physical and mechanical properties of solidified cement are accounted for. The properties of cement researched incorporate compressive, tensile strength, water retention, porousness attributes, chloride dispersion and protection from chloride particle entrance. The test outcomes demonstrate that BA is a viable admixture, with 20% as ideal substitution proportion of bond.

Advantages

- Achievement of high early strength.
- A diminishment in water porousness
- Protection from chloride penetration and dispersion

Disadvantages

- There is no discussion about carbon emissions.
- Particle packaging of material was not discussed.
- Reducing of cost was not discussed.

2.4. Amin et al. 2011(10) presents that the reusing of bagasse ash as a bond substitution in concrete, which gives a palatable answer for natural concerns related with squander administration. The effect of SBA content as a fractional substitution of cement has been explored on physical properties of solidified cement, including compressive, split tensile strength, chloride diffusion, and protection from chloride particle infiltration. The outcomes demonstrate that SBA is a compelling mineral admixture and pozzolanic with the ideal substitution proportion of 20% bond, which diminished the chloride diffusion by over half with no antagonistic impacts on different properties of the solidified cement.

2.5. P. Vinayagam et al. 2012 detailed an improved blend outline system for HPC by joining BIS and ACI code techniques for blend plan.

Based on the above strategy M80 and M100 blends are landed at. These HPC blends are tried tentatively for pressure, split strain, flexure and workability.

Disadvantages:

- Used of silica fume (SF) in solid that decreases the workability.
- The pressure disappointment example of cement is because of squashing of coarse total and not because of bond disappointment.
- Showed less estimation of pH when contrasted with solid blend without silica seethe. From the test outcomes, it is watched that the level of soaked water ingestion of the HPC blends containing silica rage was bring down when contrasted and that of HPC blends without silica smolder.

2.6 Chi et al. Sugarcane bagasse ash (SCBA), is one of the potential pozzolanic material and it can be mixed with Portland cement. In this examination, SCBA with molecule sizes <45 µm was utilized to supplant compose I normal Portland cement with different percentage (10 to 30%) by weight of fastener. The w/cm and sand/fastener proportions were kept constants. Composites were blended, and impacts of SCBA on properties were examined water retention test, introductory surface assimilation test, drying shrinkage test, compressive strength, RCPT, TGA and SEM. Trial comes about demonstrate that the stream spread of crisp mortars would diminish with an expansion of SCBA substitution. The examples with 10% SCBA have the prevalent execution on compressive strength, drying shrinkage, water retention, starting surface assimilation, and chloride particle entrance, TGA, and SEM at 56 years old days. It shows that 10% concrete substitution of SCBA might be considered as far as possible.

2.7. Sidramappa et al. 2008 used Sugarcane Bagasse Ash for HPC. They observed that

The burning temperature was found to be 900°c - 1100°c. There was uncontrolled burning and cooling of SCBA. According to literature particles burnt above 750°c to 800°c will have crystalline structure.

The compressive strength test results revealed that for 10%, 20% and 30% replacement of SCBA, the variation in strength for

M20 grade of concrete was observed to be: 11.30%, 0.94% and 24.52%

M40 grade of concrete was observed to be 1.58%, 55.8% and -60.8%

M60 grade of concrete was observed to be: 6.4%, 21.1% and 55.7%

M80 grade of concrete was observed to be : 5.95%, 16.02% and 23.95% compared to normal concrete

The results showed that for replacement of SCBA, there is no increase in strength for M80 grade of concrete in compression.

The Split tensile strength test results revealed that for 10%, 20% and 30% replacement of SCBA, the variation in strength for o M20 grade of concrete was observed to be : 13.7%, 15.3% and 52% of M60 grade of concrete was observed to be : 37.6%, 52% and 69.72% compared to normal concrete.

Binding property was inadequate. As the replacement of SCBA increased, the binding of ingredients of concrete was relatively less.

As the replacement of SCBA increased the water requirement increased, this may be because of high carbon content.

2.8. Mahender et al. 2013 used bagasse ash and observed that 20% substitution of bond by the Bagasse ash remains comes about (i.e.) the quality is relatively equivalent to the ostensible quality of the solid.

It is financially well informed as well as it decrease the cost by 12% for $1m^3$ of cement.

In this manner, a less expensive cement can be made with modern waste items for a proportionate quality.

The usage of SBA in concrete tackles the issue of its transfer hence keeping the earth free from contamination.

2.9. P.Vinayagam et al. 2012 detailed an improved blend outline system for HPC by joining BIS and ACI code techniques for blend plan.

Based on the above strategy M80 and M100 blends are landed at. These HPC blends are tried tentatively for pressure, split strain, flexure and workability.

Disadvantages:

- Used of silica fume (SF) in solid that decreases the workability.
- The pressure disappointment example of cement is because of squashing of coarse total and not because of bond disappointment.
- Showed less estimation of pH when contrasted with solid blend without silica seethe. From the test outcomes, it is watched that the level of soaked water ingestion of the HPC blends containing silica rage was bring down when contrasted and that of HPC blends without silica smolder.

2.10. Dattatray et al. 2014summed up the consequences of concentrate on silica rage based elite cement.

The endeavor has been made to look at, the 7 days and 28 days compressive strength, splitting tensile strength and flexural strength of cement by utilizing silica smolder with the typical cement of M60 review with keeping up the water bond proportion 0.3. The goal of this examination is to create concrete with great strength, less permeable, less capillarity, so solidness will be come to. For this reason, the investigation has been done on M60 review of solid, utilizing silica seethe in various rate 0%, 5%, 10%, 15% to the heaviness of bond.

Advantage

- Cement supplanting up to 10% with silica rage prompts increment in compressive quality, part elasticity and flexural quality, for both M60 grade.

Disadvantage

- After 10% there is a reduction in compressive strength, rigidity and flexural strength for 28 days period.
- Reduction in workability as we increase the SBA content, subsequently water Consumption will be high for higher substitutions.
- The greatest substitution content of silica range is 10% for M60 grade of cement.

2.11. Fairbairn et al. 2008(17) study that SCBA is created as an ignition side-effect from boilers of sugar and liquor industrial facilities. Made essentially out of silica, this side-effect can be utilized as admixture in mortar and cement. A few examinations have demonstrated that the utilization of SCBA as incomplete Portland concrete substitution can enhance a few properties of cementitious materials. It isn't yet clear if these changes are related to physical or substance impacts. This work examines the pozzolanic and filler impacts of a lingering SCBA in mortars. At first, the impact of molecule size of SCBA on the pressing thickness, pozzolanic action of SCBA and compressive strength of cubes was examined. Also, the conduct of SCBA was contrasted with that of an insoluble material of a similar pressing thickness. The outcomes demonstrate that SCBA might be named a pozzolanic material, yet that its movement depends fundamentally on its molecule size and fineness.

2.12. Amin et al. 2011(10) presents that the reusing of SBA as a cement substitution in concrete, which gives a palatable answer for natural concerns related with squander administration. The effect of SBA content as a fractional substitution of bond has been explored on physical properties of solidified cement, including compressive and splitting tensile strength, chloride diffusion, and protection from chloride particle infiltration. The outcomes demonstrate that SBA is a compelling mineral admixture and pozzolanic with the ideal substitution proportion of 20% bond, which diminished the chloride diffusion by over half with no antagonistic impacts on different properties of the solidified cement.

2.13. Marcelo Tavares et al. presents that SBA is a potential pozzolanic material. In any case, its viable application in mortar and cement requires and utilization of pounding and arrangement procedures to enable it. To accomplish the fineness it is required to meet industry principles. The present paper examines the part of plant compose and granulating circuit setup in pounding in research facility of plant-scale on the molecule estimate, particular surface zone of pozzolanic cement created ashes. It was watched that, albeit diverse size conveyances were created by the distinctive factories and processing arrangements, the pozzolanic movement of the ground ash was straightforwardly related to fineness, portrayed by its 80% passing or Blaine particular surface territory. From a low pozzolanic action of under half of the as-got ash, values over 100% could be come to after delayed crushing circumstances. Electric power prerequisites to achieve the base pozzolanic movement were evaluated to be in the request of a modern ball process. Fuse of aultrafinely-ground ash in an elite cement in halfway substitution of Portland concrete (10 to 20% by mass) brought about no quantifiable change in mechanical conduct, yet enhanced rheology and protection from entrance of chloride particles.

2.14 Gochi – ponce et al. 2012(8) investigates that the utilization of lime and SBA as synthetic stabilizers in compacted soil cubes. The cubes were tried for flexure and pressure in a dry and an immersed state.

The tests were examined at 7, 14 and 28 days, keeping in mind the end goal to assess the impacts of the expansion of lime and SBA on the mechanical properties of the compacted soil squares. The outcomes demonstrate that cubes fabricated with 10% of lime in cement with 10% of SCBA indicated preferred execution over those containing just lime. All things considered, the expansion of lime enhanced the strength of the pieces when contrasted and squares created with plain soil. As indicated by SEM and DRX investigations, significant change of the lattice was seen because of the development of solid stages, for example, CSH and CAH for the cement with added substances. It was likewise reasoned that the cement of SBA and lime as a substitution for concrete in the adjustment of compacted soil pieces is by all accounts a promising elective while thinking about issues of vitality utilization and contamination.

2.15 Silvoso et al. 2010(13) shows an investigation of concrete substitution by SCBA in modern scale meaning to diminish the CO_2 discharges into the climate. SCBA is a side-effect of the sugar agroindustry plentifully accessible in a few areas of the countries and it has chemical properties demonstrating that it can be utilized together with concrete. Late far reaching research created at the Federal University has exhibited that SCBA keeps up, or even enhances, the mechanical and toughness properties of cement based materials, for example, mortars and cements. Brazil is the world's biggest sugar cane maker and being a creating nation. A reenactment was completed to appraise the capability of CO_2 discharge diminishments and the feasibility to issue CER credits. The recreation was created inside the structure of the technique built up by the UNFCCC for the CDM. São Paulo (Brazil) was for this contextual analysis since it focuses around 60% of the national sugar stick and ash generation together with an imperative convergence of bond processing plants. Since one of the key factors to assess the CO_2 emanations is the normal separation between sugar cane production lines and the bond plants, a hereditary calculation was created to tackle this enhancement issue. The outcomes demonstrated that SCBA mixed bond decreases CO_2 discharges, which qualify this item for CDM ventures.

2.16 Filho et al. 2009(14) present work on exploratory program was done to research the impact of SCBA and RHA, separately in the properties of cements. SCBA and RHA were delivered to concrete with 0 to 20 percentage in concrete as replacement of cement by mass. SCBA and RHA were likewise created with a specific end goal to think about the advantages of the synchronous utilization of both ultrafine ashes on concrete properties. Examinations were performed to explore the yield pressure and plastic thickness, compressive strength at 7, 14 28, 90, and 180 days, Young's modulus at 28 days and fast chloride-particle vulnerability. The joint impact of the two ashes permitted achieving constructive outcomes in rheology and kept consistent or expanded the compressive strength when contrasted with the reference blends. Besides, the ternary cements exhibited bring down electric charges and the substitution of bond by 40% SCBA and RHA diminished essentially the most extreme adiabatic temperature ascent of ordinary cement.

2.17 Lima et al. 2010(12) Sugarcane today assumes a noteworthy part of economy of whole world, and Brazil is the main maker of sugar and liquor, which are essential worldwide wares. The procedure creates SBA as a waste, which is utilized as fuel to stir boilers that deliver steam for power. The last result of this consuming is lingering SBA, which is typically utilized as manure in sugarcane ranches. Ash emerges among agro industrial squanders since it comes about because of vitality creating forms. Numerous kinds of ash don't have pressure driven or pozzolanic reactivity, yet can be utilized as a part of common development as inactive materials. Showed less estimation of pH when contrasted with solid blend without silica seethe. From the test outcomes, it is watched that the level of soaked water ingestion of the HPC blends containing silica rage was bring down when contrasted and that of HPC blends without silica smolder. The outcomes showed that the SBA tests exhibited properties like those of normal sand. A few overwhelming metals were found in the SBA tests, showing the need to limit its utilization as a manure.

CHAPTER 3: EXPERIMENTAL PROGRAMME AND METHODOLOGY

3.1. MATERIALS USED: We used coarse aggregate, fine aggregate, Portland cement, sugarcane bagasse ash, water.

Cement: Cementitious material used was Portland cement. This is the main ingredient used in for bonding of concrete. The usage of other cement is possible but depends on local availability. Supplementary cementitious material is replaced with bagasse ash at about 5%, 10%, 15%, 20%, 30% and 35% with cement.

Fine aggregate: .Use of fine aggregates gives better holding or interlocking of both fine and coarse aggregates. We particularly used sand as a fine aggregate with size less than 4.75mm.

Coarse aggregate: the nominal size of coarse aggregate was 20 mm.

Water: We used M40 grade of concrete. Ratio of cement, sand and aggregate is 1:1.56:2.42 with water cement ratio of 0.464.

Sugarcane bagasse ash: SCBA has high amount of silica, alumina and ferric oxide content.

Fig-2 Sugarcane bagasse ash

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The present examination was completed on SCBA in replace of Portland cement. Which was obtained from Chandigarh in India. In this experiment, we decrease the weight of cement by 0 to 35% and replace it by sugarcane bagasse ash respectively.

3.2 METHODOLOGY

In this experiment, we used standard size of cubes with dimension of 150mm×150mm×150mm. From 10262-2009 code, we designed a mix proportion of concrete. We used M40 grade of concrete. Ratio of cement, sand and aggregate is 1:1.56:2.42 with water cement ratio of 0.464. SBA replaces cement with ratio of 0% to 35%. The elements of concrete were completely blended in blender machine till we get uniform consistency of concrete. Machine oil was spread on the inward surfaces of cubes before casting. Concrete was filled with the cube and compacted altogether utilizing table vibrator. The surface was finalize by method of trowel. The cubes were separated after 24 hours and cured submerged for 7 and 28 days. The samples were taken out from the curing tank only before the test. This test was led according to the significant Indian Standard specifications. Every one of the examples indicated the high silica (SiO2) content in SBA with percentage of 65%. As comparison to Portland cement the percentage of silica content is high in SBA.

Table no.1 Physical properties of sugarcane ash

Material	Sugarcane bagasse ash
Specific gravity	1.85
Bulk density (g/cm^2)	0.61
Specific surface (m^2/kg)	958
Mean grain size(um)	5.58

Table no.2 Chemical properties of sugarcane ash

Material	Sugarcane bagasse ash
SiO_2	65.20
Al_2O_3	10.5
Fe_2O_3	6.52
CaO	8.02
MgO	2.58
Na_2O	0.91
K_2O	1.42
Loss of ignition	4.81

3.1 Tests performed:

Compressive strength:

1. Bagasse ash-mixed concrete cube shapes was resolved following 7 and 28 days for compressive strength.
2. The compressive strength of bagasse ash-mixed solid examples are given Table 3 and table 4. For 7 and 28 days of curing times demonstrates that the compressive strength increments with expanding bagasse ash up to 15%.
3. This affirms the way that specimen with a bagasse ash substance of up to 15% grows early compressive strength as contrasted and control concrete examples. Expansion in compressive strength up to 15% concrete substitution of bagasse ash might be credited to silica content, the strength abatements to a lesser incentive than that of normal concrete. In this manner, 15% bagasse ash-mixed cement is by all accounts as far as possible.

Split tensile strength:

1. The split tensile estimations of bagasse ash-mixed cements following 28 days and 7 days of curing are given in Table 2 and 4.
2. It can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of split tensile strength increment till 15% and the range is decreases after 15%, the strength diminishes.
3. Clearly, 15% of ash content is giving optimized value.

Flexural strength:

1. The flexural strength estimations of bagasse ash-mixed cements following 28 days and 7 days of curing are given in Table 5 and 6.
2. It can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of flexural strength increment till 15% and the range is decreases after 15%, the strength diminishes.
3. Clearly, 15% of ash content is giving optimized value.

Figure–3 Casting of concrete in mould

Figure-4 Concrete block after testing

Figure -5 Concrete block after testing

Figure-6 Testing of concrete blocks

Fig - 7 Compressive strength testing

CHAPTER 4: EXPERIMENTAL RESULTS AND DISCUSSIONS

1. It indicates that SCBA provided highly flexural strength, compressive strength and split tensile strength as compare to normal concrete.
2. The outcomes demonstrates that Sugarcane Bagasse gives increment in the workability of concrete when contrasted with conventional cement.
3. The outcomes shows that SBA can be utilized 15% substitution as compared to normal concrete.

Table 3: Compressive Strength for 7 days using Sugarcane Ash (SBA)

% Replacement by SBA	Casting –I (MPa)	Casting-II (MPa)	Casting –III (MPa)	Average (MPa)
0%	34.00	35.80	30.50	33.43
5%	43.12	40.90	42.70	42.24
10%	42.56	44.66	45.00	44.07
15%	44.80	43.33	46.85	44.99
20%	42.95	40.18	40.73	41.28
25%	39.17	39.51	40.34	39.67
30%	40.55	39.41	38.15	39.37
35%	38.15	38.97	38.84	38.65

In table 3, it shows the compressive strength for 7 days and we successfully replace it by cement by 15% of sugarcane bagasse ash (SBA).

Expansion in compressive strength up to 15% concrete substitution of bagasse ash might be credited due to silica content, the strength abatements to a lesser incentive than that of normal concrete. In this manner, 15% bagasse ash-mixed cement is by all accounts as far as possible.

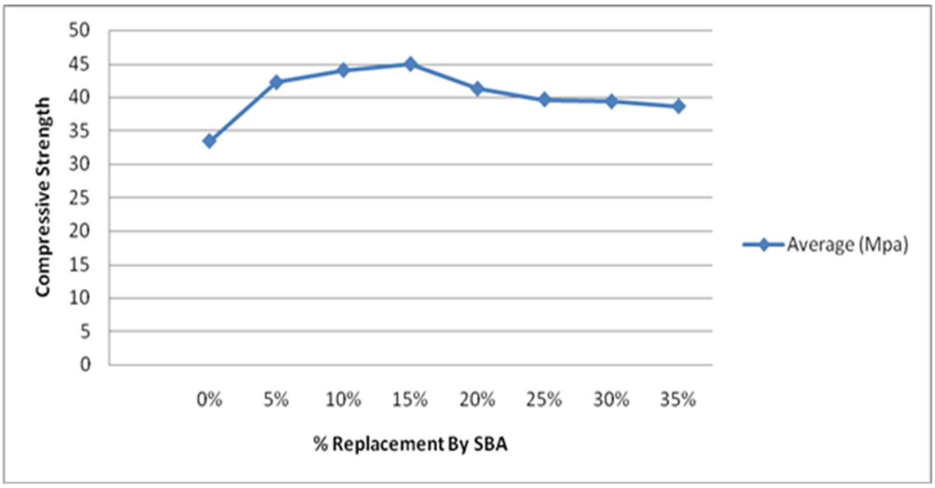

Figure 8: Average Compressive Strength for 7 days using Sugarcane Ash (SBA)

Figure 8 shows the average Compressive Strength for 7 days using Sugarcane Ash (SBA). Expansion in compressive strength up to 15% concrete substitution of bagasse ash might be credited due to silica content, the strength abatements to a lesser incentive than that of normal concrete.

Table 4: Compressive Strength for 28 days using Sugarcane Ash (SBA)

% Replacement by SBA	Casting –I (Mpa)	Casting-II (Mpa)	Casting –III (Mpa)	Average (Mpa)
0%	52.65	54.17	56.87	54.63
5%	60.77	61.09	61.52	61.12
10%	62.53	61.77	62.59	62.29
15%	63.01	53.91	63.34	63.42
20%	63.01	62.1	59.9	61.67
25%	61.18	60.8	59.7	60.56
30%	58.15	58.8	57.97	58.29
35%	58.62	56.9	58.37	57.96

In table 4, it shows the compressive strength for 28 days and we successfully replace it by cement by 15% of sugarcane bagasse ash (SBA).

Expansion in compressive strength up to 15% concrete substitution of bagasse ash might be credited due to silica content, the strength abatements to a lesser incentive than that of normal concrete. In this manner, 15% bagasse ash-mixed cement is by all accounts as far as possible.

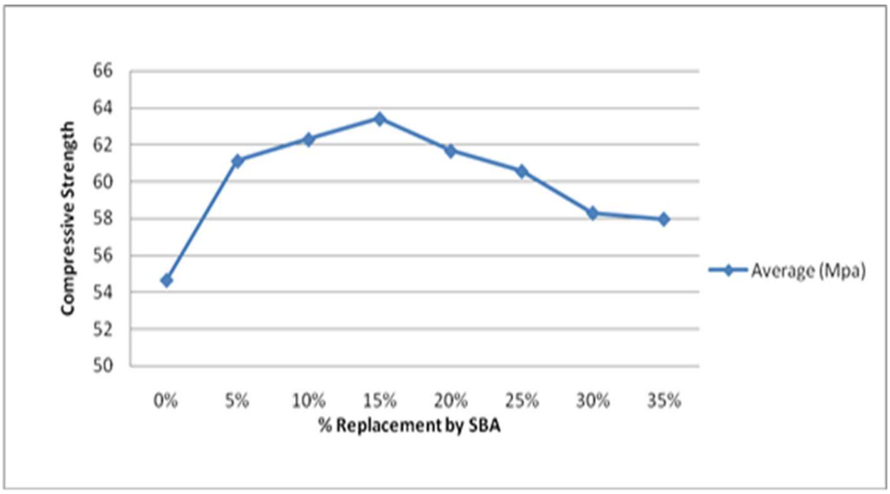

Figure 9: Average Compressive Strength for 28 days using Sugarcane Ash (SBA)

Figure 9 shows the average Compressive Strength for 7 days using Sugarcane Ash (SBA). Expansion in compressive strength up to 15% concrete substitution of bagasse ash might be credited due to silica content, the strength abatements to a lesser incentive than that of normal concrete.

Table 5: Flexural Strength Results at the age of 7 days using Sugarcane Ash (SBA)

% Replacement by SBA	Casting –I (MPa)	Casting-II (MPa)	Casting –III (MPa)	Average (MPa)
0%	3.19	3.05	3.21	3.15
5%	3.22	3.27	3.25	3.29
10%	3.37	3.42	3.49	3.42
15%	3.83	4.33	4.66	4.27
20%	3.45	3.76	3.56	3.59
25%	3.33	3.44	3.30	3.35
30%	3.26	3.37	3.21	3.28
35%	3.19	3.10	3.14	3.14

The flexural strength estimations of bagasse ash-mixed cements following 7 days of curing are given in Table 5.

It can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of flexural strength increment till 15% and the range is decreases after 15%, the strength diminishes.

Clearly, 15% of ash content is giving optimized value.

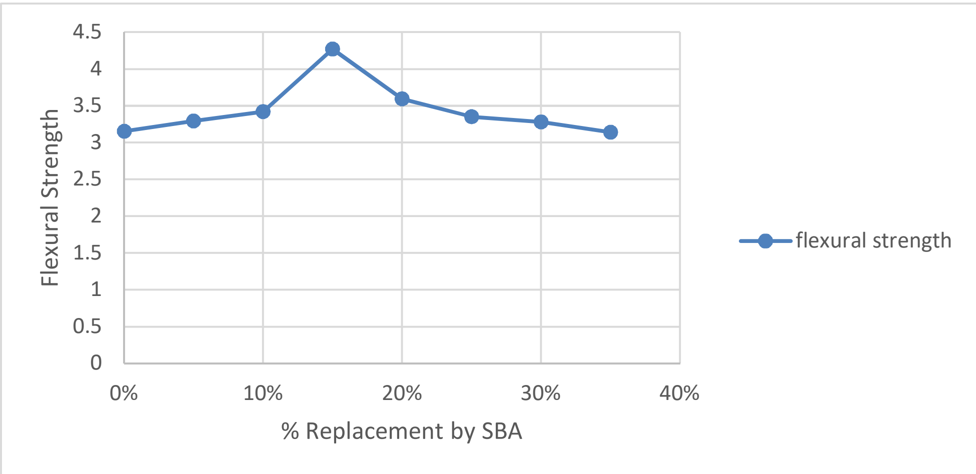

Figure 10: Flexural Strength for 7 days using Sugarcane Ash (SBA)

In figure 10 it is observed that in examples containing up to 15% of bagasse ash expansion, the range of flexural strength increment till 15% and the range is decreases after 15%, the strength diminishes.

Table 6: Flexural Strength for 28 days using Sugarcane Ash (SBA)

% Replacement by SBA	Casting –I (Mpa)	Casting-II (Mpa)	Casting –III (Mpa)	Average (Mpa)
0%	5.91	5.89	5.97	5.92
5%	7.21	7.50	7.43	7.38
10%	8.26	8.51	8.57	8.44
15%	9.21	9.54	9.77	9.50
20%	7.92	8.01	8.11	8.01
25%	8.03	7.97	7.83	7.94
30%	7.74	7.61	7.59	7.64
35%	7.55	7.65	7.48	7.56

The flexural strength estimations of bagasse ash-mixed cements following 28 days of curing are given in Table 6.

It can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of flexural strength increment till 15% and the range is decreases after 15%, the strength diminishes.

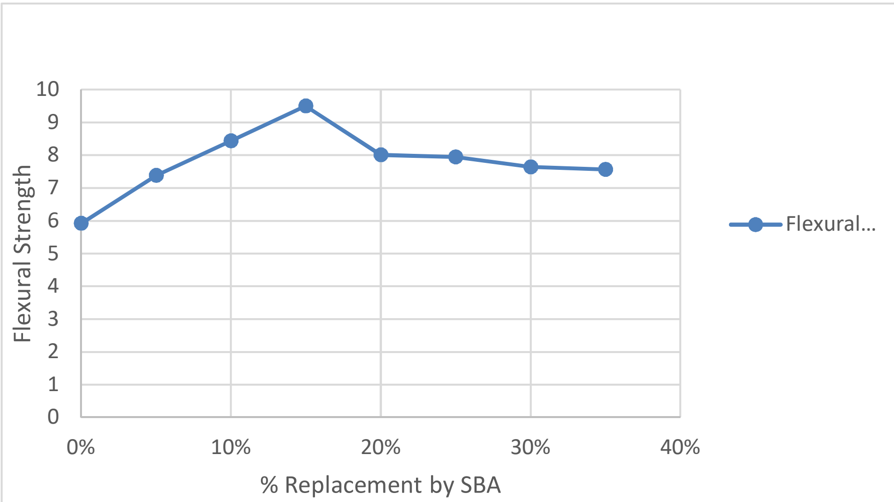

Figure 11: Flexural Strength for 28 days using Sugarcane Ash (SBA)

Table 7: Split Tensile Strength Results at the age of 7 days using Sugarcane Ash (SBA)

% Replacement by SBA	Casting –I (MPa)	Casting-II (MPa)	Casting –III (MPa)	Average (MPa)
0%	3.09	3.01	2.99	3.03
5%	3.21	3.17	3.23	3.20
10%	3.27	3.33	3.29	3.29
15%	3.33	3.36	3.41	3.36
20%	3.35	3.32	3.21	3.29
25%	3.23	3.19	3.25	3.22
30%	3.16	3.11	3.20	3.15
35%	3.11	3.14	3.09	3.11

The split tensile estimations of bagasse ash-mixed cements following 7 days of curing are given in Table 7.

It can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of split tensile strength increment till 15% and the range is decreases after 15%, the strength diminishes.

Clearly, 15% of ash content is giving optimized value.

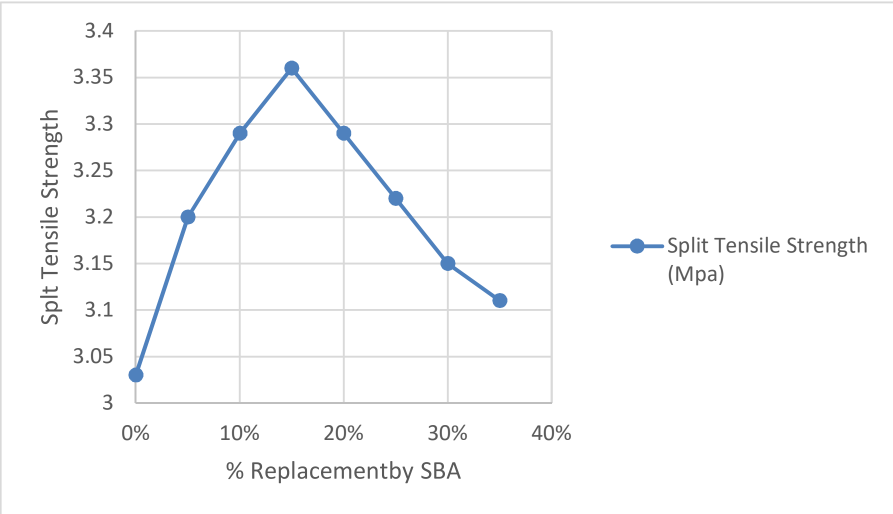

Figure 12: Split Tensile Strength for 7 days using Sugarcane Ash (SBA)

In figure 12 it can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of split tensile strength increment till 15% and the range is decreases after 15%, the strength diminishes. Clearly, 15% of ash content is giving optimized value.

Table 8: Split Tensile Strength Results at the age of 28 days using Sugarcane Ash (SBA)

% Replacement by SBA	Casting –I (Mpa)	Casting-II (Mpa)	Casting –III (Mpa)	Average (Mpa)
0%	3.17	3.11	3.20	3.16
5%	3.34	3.47	3.51	3.44
10%	3.79	3.84	3.91	3.84
15%	3.98	4.07	4.24	4.09
20%	4.12	3.96	3.90	3.99
25%	3.83	3.81	3.86	3.83
30%	3.69	3.82	3.71	3.74
35%	3.60	3.77	3.75	3.70

The split tensile estimations of bagasse ash-mixed cements following 28 days of curing are given in Table 8.

It can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of split tensile strength increment till 15% and the range is decreases after 15%, the strength diminishes.

Clearly, 15% of ash content is giving optimized value.

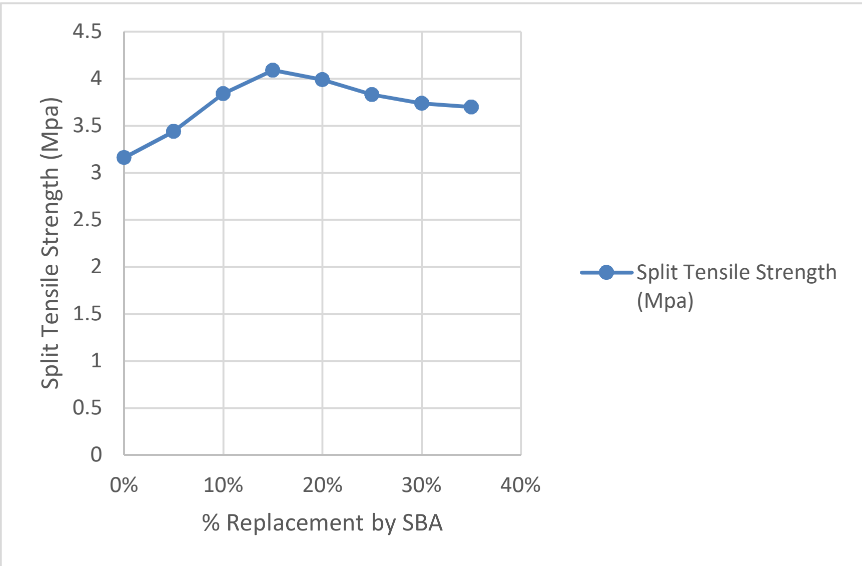

Figure 13: Split Tensile Strength for 28 days using Sugarcane Ash (SBA)

In figure 13 it can be obviously observed that in examples containing up to 15% of bagasse ash expansion, the range of split tensile strength increment till 15% and the range is decreases after 15%, the strength diminishes. Clearly, 15% of ash content is giving optimized value.

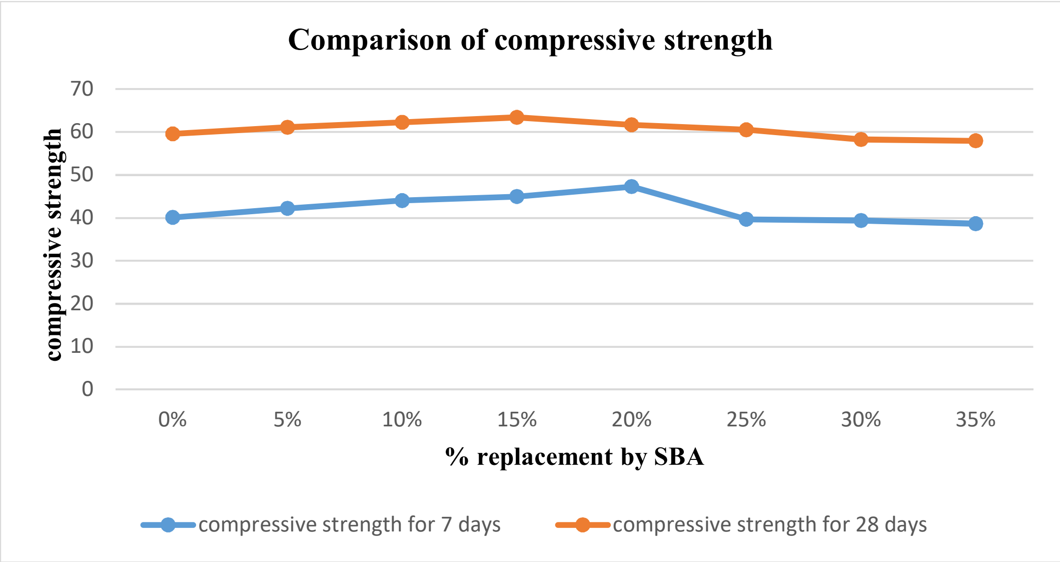

Figure 14: Comparison of Average Compressive Strength Results for 7 days and 28 days using Sugarcane Ash (SBA)

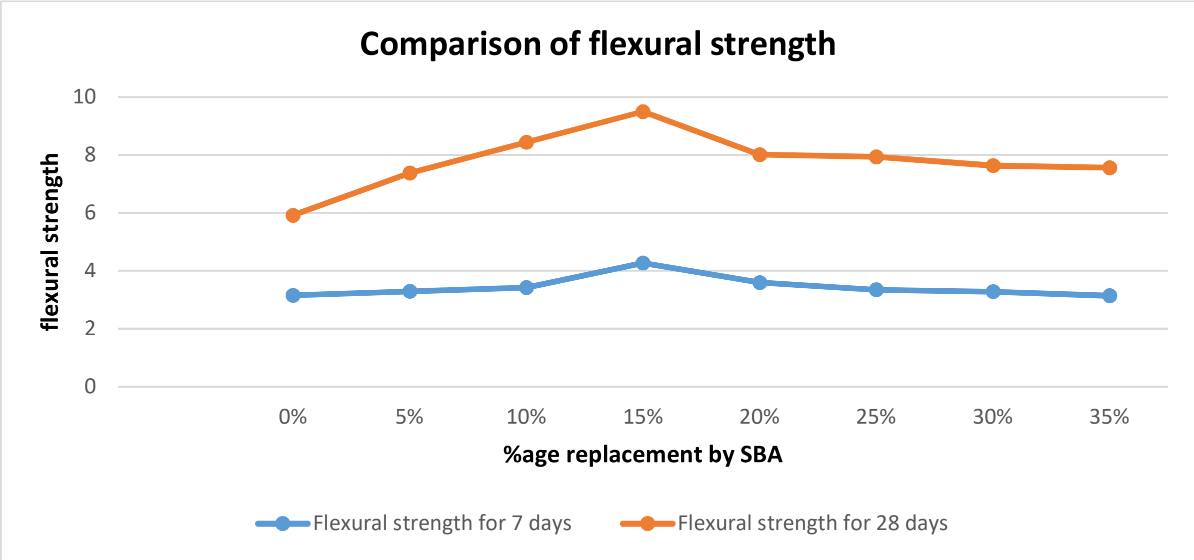

Figure 15: Comparison of Average Flexural Strength Results for 7 and 28 days using Sugarcane Ash (SBA)

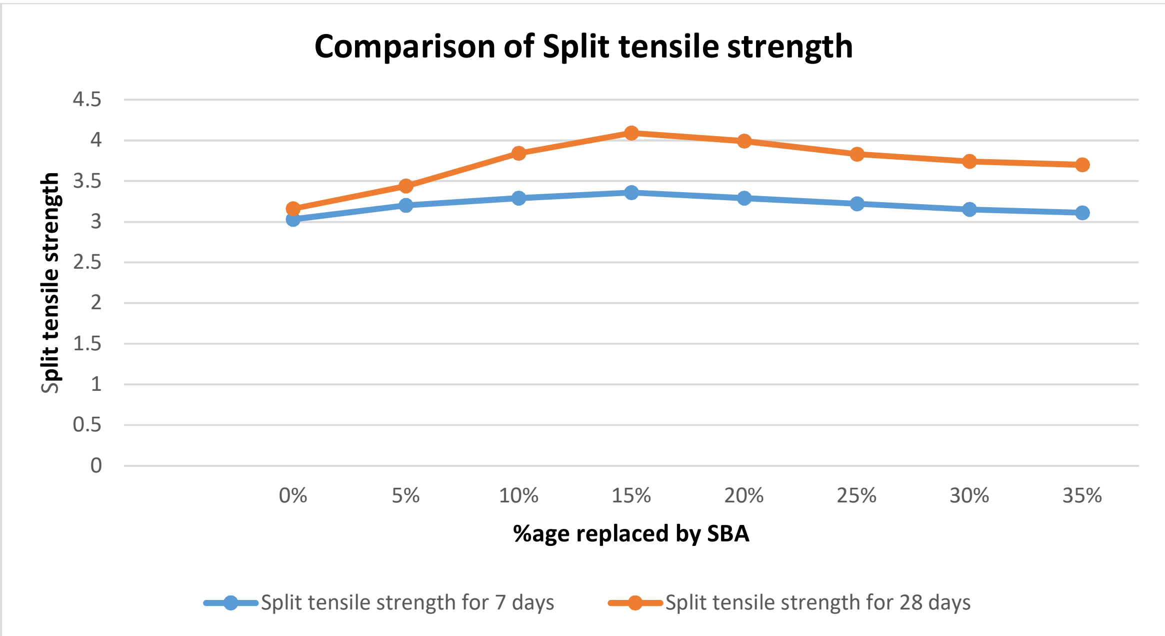

Figure 16: Comparison of Average Split tensile Strength Results for 7 and 28 days using Sugarcane Ash (SBA)

4.1 DISCUSSIONS

- In figure 8 and 9 graph shows the compressive strength for 7 days and 28 days we will successfully replace it by cement by 15% of sugarcane bagasse ash(SBA).
- In figure 10 and 11 graph shows the flexural strength for 7 days and 28 days we will successfully replace it by cement by 15% of sugarcane bagasse ash (SBA).
- In figure 12 and 13 graph shows the split tensile strength for 7 days and 28 days and we will successfully replace it by cement by 15% of sugarcane bagasse ash (SBA).
- In Figure 14 graph shows the Comparison of Average Compressive Strength Results for 7 days and 28 days using Sugarcane Ash (SBA).
- In Figure 15 graph shows the Comparison of Average flexural Strength Results for 7 days and 28 days using Sugarcane Ash (SBA).
- In Figure 16 graph shows the Comparison of Split tensile Strength Results for 7 days and 28 days using Sugarcane Ash (SBA).

CHAPTER - 5 CONCLUSIONS

1. It shows that the SCBA had highly strength for flexural, compressive and split tensile as compare to normal concrete.
2. The outcomes demonstrates that Sugarcane Bagasse gives increment in the workability of concrete when contrasted with conventional cement.
3. The outcomes shows that SBA can be utilized 15% substitution as compared to normal concrete.
4. Reduce the cost of concrete.
5. SBA reduces the CO_2 emissions from the environment.
6. SBA used as a admixture in different countries to reduce cement production and its usage in concrete.

CHAPTER 6 FUTURE WORK

1. Reduce cement production.
2. Decrease carbon emissions in the environment.
3. Decrease usage of cement in concrete and usage of mineral of admixture should be high.
4. By adding this mineral admixture, we also reduce the cost of concrete because SBA is a natural admixture.

REFRENCES

1. Reddy &Kishor I. (2017). “Study on Behaviour of Partial Replacement of Cement With Sugarcane Bagasse Ash for High Strength Concrete Mix” (IJCIET) Vol.8 Issue 1 pp.847-851.
2. Vishwakarma M., Chandak R. & Grover R. (2015). “Study on The Compressive Strength of the Concrete by Partial Replacement of Cement with Sugarcane Bagasse Ash”issue 5, Vol. 4 ISSN 2249-6149.
3. Reddy M. (2015). “Utilization of SCBA in concrete by partial replacement with cement” International (IOSR) Journal of Mech& civil Engg (IOSR-JMCE) e- ISSN: 2278-1684, P-ISSN: 2320-334X, 12 (6) 12-16.
4. Elhameed P., Hussein, Shafiq N., Nuruddin M. and Memon F. (2014), “Compressive Strength and Microstructure of Sugar Cane Bagasse Ash Concrete”ISSN 2040- 7459.
5. Modani P., (2013). “Utilization of bagasse ash as a partial replacement of fine aggregate in 0 0.2 0.4 0.6 0.8 1 A1 A2 A3 A4 A5 Water permeability test % Of Nano SCBA Chart Title 60 DAYS” International Journal of Scientific Research in Science and Technology 430 concrete, Elsevier procedia of engineering, 51,25-29.
6. Kawade U., Rathi V., Girge V., 2013. “Effect of use of Bagasse Ash on Strength of Concrete”, International Journal of Innovative Research in Science, Engineering and Technology, 2 (7) 2319- 8753.
7. AlavezR., Garcia M, (2012) “ The use of sugarcane bagasse ash and lime to improve the mechanical properties of compacted soil blocks”. Construction building materials 34, 296-305.
8. Ramirez R., Garcia P., Reyes J., Juarez D. & Ponce Y.,”The use of sugarcane bagasse and lime to improve the durability and mechanical properties of compacted soil blocks” Construction and building materials, 34: 296-305.
9. Bhalchandra S. and Shirale R. (2011). “Performance of steel fiber reinforced metakaolin concrete”, The Indian Concrete Journal, 37-43.
10. Amin N. (2011). “Use of Bagasse Ash in Concrete and its impact on the strength and Chloride resistivity” American Society of Civil Engineers, 23:717-720.
11. Sreenivasan (2010) “Experimental study on bagasse ash in concrete” International journal volume 5(2)60-66.

12. Sales A. & Lima S., (2010). "Use of Brazilian Bagasse ash in Concrete as Sand replacement", Elsvier, waste management, 30: 1114-1122.
13. Fairbairn E., Americano B., Cordeiro G., Paula T., Filho R. & Silvoso M., (2010). "Cement replacement by sugarcane bagasse ash: CO_2 emissions reduction and potential for carbon credits", Elsvier, Environmental management, 91, 1862-1871.
14. Cordeiro G., ToledoFilho R., Tavares L. &Fairbairn E.,(2009) "Ultrafine grinding of Sugarcane Bagasse ash for application as pozzolanic admixture in concrete", Elsvier Cement and Concrete research, 39: 110-115.
15. IS 10262: 2009, "Indian Standard, recommended guidelines for concrete mix designs", Bureau of Indian Standard, New Delhi.
16. Chusilp N., Jaturapitakkul C. &Kiattikomol K. (2009) "Utilization of bagaase ash as a pozzolonic material in concrete" Elsevier Construction and building materials, 23, 3352-3358.
17. Cordeiro G., ToledoFilho R., Tavares L. &Fairbairn E.,(2008). "Pozzolanic activity and filler effect of sugarcane bagasse ash in Portland cement and lime mortars", Cement and Concrete composites, 30, 410-418.
18. Cordeiro G., ToledoFilho R., Tavares L. &Fairbairn E.,(2008) " Pozzolanic activity and filler effect of sugarcane bagasse ash in portaland cement and lime mortars" Elsevier Cement and concrete composites, 30: 410-418.
19. Ganesan K., Rajagopal K., Thangavel K., (2007)."Evaluation of bagasse ash as supplementary cementitious material. CemConcr Comp"29:515–24.
20. Payá J. (2007). "Sugarcane bagasse ash (SCBA): studies on its properties for reusing in concrete production", Journal of Chemical technology and Biotechnology, 77, 321-325,.