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Experimental Study On Bagasse Ash In Concrete

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ABSTRACT

Slag is very effective in the design and development of high strength concrete. The main parameter investigated in this study is M35 grade concrete with partial replacement of coarse aggregate by furnace slag by 50% to 60% and by 70%.This paper presents the result of an experimental investigation caring out to find the sustainability of furnace slag in concrete and compressive strength, split tensile strength, flexural strength is attained at the age of 7days and 28 days. Durability study on acid attack was also studied and percentage of weight loss is compared with normal concrete. Test result indicates that use of furnace slag in concrete has improved the performance of concrete in strength as well as durability aspect. Slag, the by-product of steel and iron producing processes, has been used in civil engineering for more than 100 years. Furnace Slag, which is also addressed as Steel Slag in this paper, has no pozzolanic activity. The cost optimization is find out by comparing one m³ of conventional concrete and slag concrete resulting high strength of slag with coarse aggregate replacement. In this project, a study was made to obtain low cost building materials using industrial wastes (welding and furnace slags). The objective of the study is to use these wastes in low-cost construction with adequate compressive strength. The knowledge on the strength and permeability of concrete containing furnace slag could be beneficial in the utilization of these waste materials in concrete work.
Keywords: Experimental, Study, Bagasse Ash, Concrete

1.INTRODUCTION

Ordinary Portland cement is recognized as a major construction material throughout the world .Industrial wastes, such as blast furnace slag, fly ash and silica fume are being used as supplementary cement replacement materials. Currently, there has been an attempt to utilize the large amount of bagasse ash, the residue from an in-line sugar industry and the bagasse-biomass fuel in electric generation industry..When this waste is burned under controlled conditions, it also gives ash having amorphous silica, which has pozzolanic properties. A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement5. Therefore it is possible to use bagasse ash (SCBA) as cement replacement material to improve quality and reduce the cost of construction materials.The present study was carried out on SCBA obtained by controlled combustion of bagasse, which was procured from the Tamilnadu province in India.This paper analyzes the effect of SCBA in concrete by partial replacement of sand at the ratio of 10%, 20%, 30% . The experimental study examines the compressive strength, split tensile strength, flexural strength concrete. The main ingredients consist of Portland cement, SCBA, river sand, coarse aggregate and water. After mixing, concrete specimens were casted and subsequently all test specimens were cured in water at 7,14 and 28 Days. Sugarcane is an important food crop for tropics and subtropics. It is the major raw materials used for sugar production. Sugarcane bagasse (SCB) is the waste produced after juice extraction from sugarcane. The Sugarcane bagasse ash (SCBA) is obtained as by product of control burning of sugarcane bagasse. SCBA constitutes an environmental nuisance as they form refuse heaps in areas they are disposed. It is cultivated in about seventy four countries between 400N and 32.50S, approximately encompassing half of the globe (Agboire et al., 2002). Brazil and India are the world’s major sugarcane producing countries with Brazil having over of 719 million tons in 2010 and recorded one-third of the world’s total sugarcane. Nigeria produced over 15 million tons of sugarcane last year. Some states where sugarcane is mostly produced in Nigeria are Sokoto, Taraba, Niger, Kogi and generally most Northern part. SCBA from sugar producing companies is not readily available since most developing countries relied on imported sugar import. In the past, SCB was burnt as a means of solid waste disposal. But with the increasing cost of the natural gas, electricity and fuel, and with the calorific properties of these wastes, bagasse has been used as the principal fuel in cogeneration plants to produce electric power. SCBA is usually obtained under controlled burning conditions in the bailers of the cogeneration processes.Thus, the ash may contain black particles due to the presence of carbon and crystalline silica when burning occurs under high temperature (above 800oc) or for a prolonged time. The nature of ash can be altered by controlling the parameters such as temperature and rate of heating. Search for alternative binders or cement replacement materials has become a challenge for national development and forward planning. Since last few years, tremendous efforts have been made to increase the use of materials to partially replacement cement in concrete works. In this study, the bagasse ash was collected in the wet condition from a disposal area. It was air-dried completely before characterization and use. The sample of raw bagasse ash consists of three different types of particles, namely, fine burnt particles, coarse fibrous unburnt (CFU) particles and fine fibrous unburnt (FFU) particles. Most of the particles of raw bagasse ash are completely burnt fine particles. The presence of fibrous unburnt particles (CFU and FFU) was visually observed in the raw bagasse ash. Incomplete burning of plant cellular structured fibers leads to presence of more amounts of fibrous particles in the raw bagasse ash. The structure and size of these fibrous particles are entirely different from the burnt fine particles.

2.MATERIAL COLLECTION

2.1 Cement

Ordinary Portland cement, 53Grade conforming to IS: 269 – 1976.Ordinary Portland cement, 53Gradewas used for casting all the Specimens. Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used. It is also important to ensure compatibility of the chemical and mineral admixtures with cement.

2.2 Fine Aggregate

Locally available river sand conforming to Grading zone II of IS: 383 –1970. Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm Sieve will be used for casting all the specimens.

2.3 Coarse Aggregate

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 12.5 mm as per IS: 383 – 1970. Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability.

2.4 Bagasse Ash

Is one of the major crops grown in over 110 countries and its total production is over 1500 million tons. In India production is over 300 million tons/year that cause around 10 million tons of bagasse ash as an un-utilized and waste material. After the extraction of all economical sugar from , about 40-45 percent fibrous residue is obtained, which is reused in the same industry as fuel in boilers for heat or power generation leaving behind 8 -10 percent ash as waste, known as bagasse ash (SCBA).

2.4.1 Advantages Of Using Bagasse Ash

Land pollution: Primarily the ash disposal problem from sugar industry is reduced since it is usually disposed off in open land area. Economy: Due to the non-availability of fine aggregate, the price of natural sand which is used as fine aggregate has increased by three folds in the past few months. Hence the overall cost involved in the construction is reduced. Future demand: Partial replacement will also help in meeting the increasing demand for fine aggregate in future. The recent average results of the chemical analyses of the sugarcane bagasse ash from Kinana and Guenaid sugar factories revealed that sugarcane bagasse combustion products (ash) resembles pozzolana in chemical nature. Therefore, it should be considered as an important mineral resource in Sudan. It might be successfully used as an engineering material for a wide variety of applications. The chemical investigations on the bagasse ash carried in this study indicated that it has had more or less the same chemical composition of other artificial pozzolanic material, like fly ash or any other conventional pozzolana.

2.5 Water

Casting and curing of specimens were done with the potable water that is available in the college premises.

3. MATERIAL PROPERTIY

3.1. Physical Properties Of Cement and given in Table.3.1

Table 3.1: Physical Properties Of Cement

S.NO	PROPERTY OF CEMENT	VALUE
1	Fines of cement	7.5%
2	Grade of cement	53 Grade(OPC)
3	Specific gravity of cement	3.15
4	Initial setting time	30min
5	Final setting time	600min
6	Normal consistency	35%

3.2. Propertiy Of Fine Agreggate

Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm Sieve will be used for casting all the specimens.(Table.3.2)

Table.3.2: Properties Of Fine Agreggate

S.NO	PROPERTIES	VALUE
1	Specific Gravity	2.65
2	Fineness Modulus	2.25
3	Water absorption	1.5%

3.3 Propertiy Of Coarse Aggregate

Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability. (Table.3.3)

Table.3.3: Propertiy Of Coarse Aggregate

S.NO	PROPERTY	VALUES
1	Specific Gravity	2.68
2	Size Of Aggregates	20mm
3	Fineness Modulus	5.96
4	Water absorption	2.0%
5	Impact Test	15.2%
6	Crushing Test	22.5%

3.4 Propertiy Of Bagasse Ash

The bagasse consists of approximately 50% of cellulose, 25% of hemicellulose and 25% of lignin. Each ton of generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash. The residue after combustion presents a chemical composition dominates by silicon dioxide ($SiO2$). In spite of being a material of hard degradation and that presents few nutrients, the ash is used on the farms as a fertilizer in the harvests. In this bagasse ash was collected during the cleaning operation.With the ever increasing demand and consumption of cement and in the backdrop of waste management, scientists and researchers all over the world are always in quest for developing alternate binders that are environment friendly and contribute towards sustainable management. Sugarcane bagasse (SCB) which is a voluminous by-product in the sugar mills when juice is extracted from the cane. It is, however, generally used as a fuel to fire furnaces in the same sugar mill that yields about 8-10% ashes containing high amounts of un-burntmatter, silicon, aluminum, iron and calcium oxides. But the ashes obtained directly from the mill are not reactive because of these are burnt under uncontrolled conditions and at very high temperatures. The ash, therefore, becomes an industrial waste and poses disposal problems. For obtaining amorphous and reactive sugarcane bagasse ash (SCBA), several trials were conducted to define optimum burning time and temperatures. SCBA used in this study was obtained by burning SCB at 600oC for 5 hours (James and Rao, 1986) under controlled conditions and its physical, chemical, and mineralogical characterization was done to evaluate the possibility of its use as binder partially replacing cement in the mortar applications.(Table.3.4)

A high-quality concrete is one which has acceptable workability (around 6.5 cm slump height) in the fresh condition and develops sufficient strength. Basically, the bigger the measured height of slump, the better the workability will be, indicating that the concrete flows easily but at the same time is free from segregation. Maximum strength of concrete is related to the workability and can only be obtained if the concrete has adequate degree of workability because of self compacting ability. The workability of C0 and N series concrete are presented in Figure 2. The figure shows the influence of SCBA content on the workability of mixtures at constant water to binder ratio of 0.48. The results show that unlike the C0 series, all investigated SCBA mixtures had high slump values and acceptable workability. This may be due to the increasing in the surface area of sugarcane ash after adding SCBA that needs less water to wetting the cement particles.

Table.3.4 Propertiy Of Bagasse Ash

COMPOSITION OF BAGASSE	COMPONENT MASS%
SiO2	78.34
Al2	8.55
Fe2O	3.61
CaO	2.15
Na2O	0.12
K2O	3.46
MnO	0.13
TiO2	0.50
BaO	<0.16
P2O5	1.07
LOSS OF IGNITION	0.42

High specific surface area and chemical composition (SiO_2 + Al_2O_3+ Fe_2O_3 > 70% and CaO >10%) suggested the pozzolanic and cementitious nature of SCBA according to ASTM C-618 standards. A hump between 2θ: 20o~39o in the XRD. showed the amorphousness of minerals, though a little crystallization of the minerals was noticed. Retardation in setting time was also recorded with the increase in SCBA %age, which might have been due to the reduction in the calcium hydroxide (CH) contents (Neville, 1995). Compressive strength (CS) values of blended mortars at 3days were higher than CTR. It can be attributed to densely packed structure owing to the higher specific surface area of SCBA. At 91days CS values for SC10 and SC15 were 104 and 102% of that of CTR. The respective values for SC20 and SC25 were 92 and 84% of CTR. At 91days flexural strength (FS) for SC10 and SC15 was 104 and 101% of CTR; almost same trends as in CS tests. This may have been both due to physical and chemical processes. It may also have introduced a large number of nucleation sites in the system for the rapid precipitation of hydration products (Singh et al., 2000) coupled with pozzolanic reaction that took place between CH and active SiO_2 and also the hydration of silica itself in the alkaline environment. But the hydration reaction was slow in SC20 and SC25, possibly due to low reactivity of SiO_2 and the reduction in CaO contents. UPV values for SC10 and SC15 were also higher than CTR showing the continuous progression in strength development.

3.5 Properties Of Water

Water used for mixing and curing shall be clean and free from injurious amounts of Oils, Acids, Alkalis, Salts, Sugar, Organic materials Potable water is generally considered satisfactory for mixing concrete Mixing and curing with sea water shall not be permitted. The pH value shall not be less than 6

4 EXPERIMENTAL PROCEDURES

4.1 CONSTITUENT MATERIALS USED

Materials that are used for making concrete for this study will be tested before casting the specimens. The preliminary tests will be conducted for the following materials.

- Cement
- Fine aggregate
- Coarse aggregate
- Water
- Bagasse ash

4.1.1 CEMENT

Cement used in construction is characterized as hydraulic or non-hydraulic. Hydraulic cements (e.g., Portland cement) harden because of hydration, chemical reactions that occur independently of the mixture's water content; they can harden even underwater or when constantly exposed to wet weather. The chemical reaction that results when the anhydrous cement powder is mixed with water produces hydrates that are not water-soluble. Non-hydraulic cements (e.g., lime and gypsum plaster) must be kept dry in order to retain their strength. The most important use of cement is the production of mortar and concrete. The bonding of natural or artificial aggregates to form a strong building material that is durable in the face of normal environmental effects.

Physical Properties

Portland cements are commonly characterized by their physical properties for quality control purposes. Their physical properties can be used to classify and compare Portland cements. The challenge in physical property characterization is to develop physical tests that can satisfactorily characterize key parameters.

Setting Time

Cement paste setting time is affected by a number of items including: cement fineness, water-cement ratio, chemical content (especially gypsum content) and admixtures. Setting tests are used to characterize how a particular cement paste sets.

Setting is mainly caused by C3A and C3S and results in temperature rise in the cement paste. False set :No heat is evolved in a false set and the concrete can be re-mixed without adding water. Occures due to the conversion of unhydreous/ semihydrous gypsum to hydrous gypsum(CaSO4.2H2O) Flash Set: is due to absence of Gypsum. Specifically used for under water repair.

Consistency

The consistency is measured by the Vicat apparatus using a 10mm diameter plunger. A trial paste of cement and water is mixed and placed in the mold having an inside diameter of 70mm at the base and 60mm at the top, and a height of 40mm. The plunger is then brought into contact with the top surface of the paste and released. Under the action of its weight the plunger will penetrate the paste. The depth depending on the consistency. When the plunger penetrates the paste to a point 5 to 7mm from the bottom of the mold. The paste is considered to be at “normal consistency”.

Soundness

• When referring to Portland cement, "soundness" refers to the ability of a hardened cement paste to retain its volume after setting without delayed expansion. This expansion is caused by excessive amounts of free lime (CaO) or magnesia (MgO). Most Portland cement specifications limit magnesia content and expansion.

• The cement paste should not undergo large changes in volume after it has set. However, when excessive amounts of free CaO or MgO are present in the cement, these oxides can slowly hydrate and cause expansion of the hardened cement paste.

• Soundness is defined as the volume stability of the cement paste.

Fineness

Fineness, or particle size of Portland cement affects Hydration rate and thus the rate of strength gain. The smaller the particle size, the greater the surface area-to-volume ratio, and thus, the more area available for water-cement interaction per unit volume. The effects of greater fineness on strength are generally seen during the first seven days. When the cement particles are coarser, hydration starts on the surface of the particles. So the coarser particles may not be completely hydrated. This causes low strength and low durability. For a rapid development of strength a high fineness is necessary.

Strength

Cement paste strength is typically defined in three ways: compressive, tensile and flexural. These strengths can be affected by a number of items including: water cement ratio, cement-fine aggregate ratio, type and grading of fine aggregate, curing conditions, size and shape of specimen, loading conditions and age.

4.1.2 Fine Aggregates

“Fine aggregate” is defined as material that will pass a No. 4 sieve and will, for the most part, be retained on a No. 200 sieve. For increased workability and for economy as reflected by use of less cement, the fine aggregate should have a rounded shape. The purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent. Coarse aggregate is a material that will pass the 3-inch screen and will be retained on the No. 4 sieve. As with fine aggregate, for increased workability and economy as reflected by the use of less cement, the coarse aggregate should have a rounded shape. Even though the definition seems to limit the size of coarse aggregate, other considerations must be accounted for.

4.1.3 Coarse Aggregates

Broken granite stone/gravel and its size is 4.75mm gauge plus i.e., retained on 4.75mm IS sieve.Coarse aggregates are particles greater than 4.75mm, but generally range between 9.5mm to 37.5mm in diameter. They can either be from Primary, Secondary or Recycled sources. Primary, or 'virgin', aggregates are either Land- or Marine-Won. Gravel is a coarse marine-won aggregate; land-won coarse aggregates include gravel and crushed rock. Gravels constitute the majority of coarse aggregate used in concrete with crushed stone making up most of the remainder. Secondary aggregates are materials which are the by-products of extractive operations and are derived from a very wide range of materials.

4.1.4 Bagasse Ash

The bagasse is an important by-product of the sugar cane industry and most of it is used to produce steam and electricity in a co-generation plant at the ethanol plant . After the bagasse combustion, a new by –product is the Sugar Cane Bagasse Ash (SCBA). It consists mainly of silica (SiO2), which indicates its potential as mineral admixture for use in concrete. The results of this research program indicated that SCBA can be used as a pozzolan and substitute cement. Since durability is a very important issue for implementing new construction materials, in this Thesis, the results of tests of sulphate attack on concrete cubes made with SCBA. These tests indicated that SCBA improves the durability of a reference. Comparison of the results from the 7, and 28 days samples shows that the compressive strength, tensile strength and also flexure increases with SCBA up to 1.0% replacement (N1) and then it decreases, although the results of 2.0% replacement (N4) is still higher than those of the plain cement concrete (C0). It was shown that the use of 2.0% SCBA decreases the compressive strength to a value which is near to the control concrete.

5. MIX DESIGN

5.1 Definition

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible.

5.2 Objective Of Mix Design

- The objective of concrete mix design as follows.
- The first objective is to achieve the stipulated minimum strength.
- The second objective is to make the concrete in the most economical Manner. Cost wise all concrete's depends primarily on two factors, namely cost of material and cost of labour. Labor cost, by way of formwork, batching, mixing, transporting and curing is namely same for good concrete.

5.3 Factors To Be Considered In Mix Design

1. Grade of concrete
2. Type of cement
3. Type & size of aggregate
4. Type of mixing & curing
5. Water /cement ratio
6. Degree of workability
7. Density of concrete
8. Air content

6.TESTING PROCEDURE

6.1 Compressive Strength Test

At the time of testing, each specimen must keep in compressive testing machine. The maximum load at the breakage of concrete block will be noted. From the noted values, the compressive strength may calculated by using below formula.

Compressive Strength = Load / Area

Size of the test specimen=150mm x 150mm x 150mm

1. Representative samples of concrete shall be taken and used for casting cubes 15 cm x 15 cm x 15 cm or cylindrical specimens of 15 cm dia x 30 cm long.
2. The concrete shall be filled into the moulds in layers approximately 5 cm deep. It would be distributed evenly and compacted either by vibration or by hand tamping. After the top layer has been compacted, the surface of concrete shall be finished level with the top of the mould using a trowel; and covered with a glass plate to prevent evaporation.
3. The specimen shall be stored at site for 24+ ½ h under damp matting or sack. After that, the samples shall be stored in clean water at $27+2^0$C; until the time of test. The ends of all cylindrical specimens that are not plane within 0.05 mm shall be capped.
4. Just prior to testing, the cylindrical specimen shall be capped with sulphur mixture comprising 3 parts sulphur to 1 part of inert filler such as fire clay.
5. Specimen shall be tested immediately on removal from water and while they are still in wet condition.
6. The bearing surface of the testing specimen shall be wiped clean and any loose material removed from the surface. In the case of cubes, the specimen shall be placed in the machine in such a manner that the load cube as cast, that is, not to the top and bottom.
7. Align the axis of the specimen with the steel platen, do not use any packing.
8. The load shall be applied slowly without shock and increased continuously at a rate of approximately 140 kg/sq.cm/min until the resistance of the specimen to the increased load breaks down and no greater load can be

sustained. The maximum load applied to the specimen shall then be recorded and any unusual features noted at the time of failure brought out in the report.

6.1.1 Preparation Of Cube Specimens

The proportion and material for making these test specimens are from the same concrete used in the field.

Mixing

Mix the concrete either by hand or in a laboratory batch mixer

Hand Mixing

(i)Mix the cement and fine aggregate on a water tight none-absorbent platform until the mixture is thoroughly blended and is of uniform color

(ii)Add the coarse aggregate and mix with cement and fine aggregate until the coarse aggregate is uniformly distributed throughout the batch

(iii)Add water and mix it until the concrete appears to be homogeneous and of the desired consistency

Sampling

(i) Clean the mounds and apply oil

(ii) Fill the concrete in the molds in layers approximately 5cm thick

(iii) Compact each layer with not less than 35strokes per layer using a tamping rod (steel bar 16mm diameter and 60cm long, bullet pointed at lower end)

(iv) Level the top surface and smoothen it with a trowel

Curing

The test specimens are stored in moist air for 24hours and after this period the specimens are marked and removed from the molds and kept submerged in clear fresh water until taken out prior to test.

Precautions

The water for curing should be tested every 7days and the temperature of water must be at 27+-2oC. It is quite clear that due to **Poisson's effect**, cube or cylinder specimens undergo lateral expansion. The steel platens don't undergo lateral expansion to the same extent that of concrete. There exists a differential tendencies of lateral expansion between steel platens and concrete cube faces; as a result of which tangential forces are induced between the end surfaces of the concrete specimen and the adjacent steel platens of the testing machine (Figure.6.1).

The degree of platen restraint on the concrete section depends on the friction developed at the concrete-platen interfaces, and on the distance from the end surfaces of the concrete.As a result, in addition to applied compressive stress, lateral shearing stresses are also effective in the concrete specimen. Effect of this shear decreases towards the centre of cube; so that sides of cube have near vertical cracks at cube's centre (Figure.6.1), or completely disintegrates so as to leave a relatively undamaged central core.As the degree of end restraint depends on the friction at the interfaces, this frictional value can be eliminated by applying grease, graphite or paraffin wax to the bearing surfaces of the specimen. It helps the specimen to undergo a larger and uniform lateral expansion and eventually splits along its full length.

Figure. 6.1 Compression Test

Figure.6.2 Split Tensile Test

6.2 Split Tensile Test

The size of cylinders 300 mm length and 150 mm diameter are placed in the machine such that load is applied on the opposite side of the cubes are casted. (Figure.6.2)Align carefully and load is applied, till the specimen breaks. The formula used for calculation.(Figure.6.2)

Split tensile strength = 2P/ µdl

6.3 Flexural Strength Test

During the testing, the beam specimens of size 7000mmx150mmx150mm were used. Specimens were dried in open air after 7 days of curing and subjected to flexural strength test under flexural testing assembly. Apply the load at a rate that constantly increases the maximum stress until rupture occurs. The fracture indicates in the tension surface within the middle third of span length. (Figure.6.3)


Figure.6.3 Flexural Strength Test

7.TEST RESULT

Ratios For Special Concrete (Extra Ingredients)
RATIO –I
Bagasse ash – 10% by replacement of Sand
RATIO - II
Bagasse ash – 20% by replacement of Sand
RATIO – III:
Bagasse ash – 30% by replacement of Sand
Above all ingredients are added by weight of Sand

- Compressive Strength Of Cube For 7 Days,14 days and 28 days are given in Table 7.1,Table.7.2 and Table 7.3
- Split Tensile Test For Cylinder 7 Days,14 days and 28 days are given in Table 7.4,Table.7.5 and Table 7.6
- Flexural Strength Of Beam For 7 Days,14 days and 28 days are given in Table 7.7,Table.7.8 and Table 7.9

Table.7.1: Compressive Strength Of Cube – 7 days

Control Mix	Best Compressive Strength in N/mm^2 7 Days			
	CC (0%)	10%	20%	30%
M30	16	18.5	22.5	20.6

Table 7.2: Compressive Strength Of Cube – 14 days

Control Mix	Best Compressive Strength in N/mm^2 14 Days			
	CC (0%)	10%	20%	30%
M30	23	23.8	24.2	22.6

Table.7.3: Compressive Strength Of Cube – 28 days

Control Mix	Best Compressive Strength in N/mm^2 28 Days			
	CC (0%)	10%	20%	30%
M30	28.6	28.8	29.20	28.95

Table.7.4: Split Tensile Test For Cylinder– 7 days

Control Mix	Best split tensile Strength in N/mm^2 7 Days			
	CC (0%)	10%	20%	30%
M30	1.02	1.25	1.43	1.18

Table.7.5: Split Tensile Test For Cylinder – 14 days

Control Mix	Best split tensile Strength in N/mm^2 14 Days			
	CC (0%)	10%	20%	30%
M30	1.58	1.86	2.20	2.06

Table.7.6: Split Tensile Test For Cylinder– 28 days

Control Mix	Best split tensile Strength in N/mm^2 28 Days			
	CC (0%)	10%	20%	30%
M30	2.02	2.30	2.56	2.35

Table.7.7: Flexural Strength Of Beam – 7 days

Control Mix	Best flexural strength In N/mm² 7 Days			
	CC (0%)	10%	20%	30%
M30	2.06	2.86	3.25	2.78

Table.7.8 : Flexural Strength Of Beam– 14 days

Control Mix	Best flexural strength In N/mm² 14 Days			
	CC (0%)	10%	20%	30%
M30	2.35	2.92	3.68	3.56

Table.7.9: Flexural Strength Of Beam – 28 days

Control Mix	Best flexural strength In N/mm² 28 Days			
	CC (0%)	10%	20%	30%
M30	2.56	3.84	4.25	3.96

8.CONCLUSION

Bagasse ash belongs to zone lV as per IS code. Water requirement increased as the percentage of BA increased. Unit weight of the mixture produced decreased as the percentage of BA increased. Workability of the mixtures depended primarily on the percentage of BA used. This is consistent with the porous nature of BA particles whereby a greater surface area and larger . average particle size serve to enhance absorption of water. Only the slump properties of the control and 10 percent BA mixture were acceptable, while the other mixtures were compromised by a decrease in slump relative to the amount of BA present .The compressive strength results represent that the strength of the mixes with 10% and 20% and 30%bagasse ash increased at later days (28 days) as compared to 7 days that may be due to pozzolanic properties of bagasse ash. The greatest compressive strength, split tensile strength and flexural strength were achieved when the mixture contained 10% of fine aggregate replacement of BA with the water cement ratio of 0.43. Hence we concluded that the fine aggregate upto 20% can be effectively replaced with sugarcane bagasse ash without considerable loss of workability and strength. Based on the conducted experiment and according to the results obtained, it can be concluded that: Bagasse ash can increase the overall strength of the concrete when used up to a 30% sand replacement level with w/c ratio of 0.35.Bagasse ash is a valuable pozzolanic material and it can potentially be used as a partial replacement for sand. This could reduce the environmental problems and minimize the requirement of land fill area to dispose BA.

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