Effets Of Sugar, Jaggery & Sugar Cane Ash On Properties Of Concrète

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Abstract:

Concrete is a most necessary material in human life because almost all civil engineering structures are constructed with concrete. In transportation generally rigid pavements are laid by concrete. Because of its rapid usage many number of researches are taking place to improve the properties of concrete & to suggest replaceable materials for concrete. This report emphasis that by using locally available materials like sugar & jaggery, can improve the properties of concrete. The admixtures (jaggery) are added into concrete at the dosage levels of 0,0.05,0.1% and check the properties improvements in concrete. And also sugar cane ash which is the waste released from sugar industries during preparation of sugar can be used as replaceable material for cement. At different proportions like 10, 15, 20, 25 & 30 % Ash.

Keywords: Jaggery, Sugarcane Bagasse Ash, Compressive Strength, split tensile strength, flexural strength , Workability.

I. INTRODUCTION

Concrete is an inevitable material in the human being's life, because of its superior characteristics like strength and durability, but in certain situations it can't be used in all places because of low setting time of concrete. Retarders are used in the concrete composition to improve the setting time and also to increase the temperature of the composition with different type of admixtures. It is observed that in Gandi+kota at Kadapa (dist), that bonding between the stones was achieved by mortar with combination of lime, sand and jaggery juice. Concrete made with admixtures like sugar and jaggery can be utilized in particular situations. Usage of these admixtures will decrease the segregation and bleeding. Sugar is a carbohydrate, a substance composed of carbon, oxygen and hydrogen. Jaggery is made from the product of sugar cane. So, both are useful to add as an admixtures in the concrete composition. Cement is the third most energy intensive material after steel and aluminium produced in tons. Cement industry consumes raw materials rich in silica, alumina, iron and calcium. Therefore this industry has been actively involved in finding ways to use waste products in the manufacturing of cement both as secondary fuel and raw material. Sugar manufacturing is the major agro industry in India. Initiatives are emerging worldwide to control and regulate the management of sub - products, residuals, and industrial waste in order to preserve the environment from the point of view of environmental contamination as well as the preservation and care of natural areas. Recently the use of recycled materials as concrete ingredients has been gaining popularity because of increasingly stringent environmental legislation. The most conspicuous of these is sugarcane bagasse ash, a finely ground waste product from the sugarcane industry. So these materials are used to change the properties of concrete like workability and compressive strength with less cost.

2.CONCRETE RESULTS

2.1 SLUMP CONE TEST

The strength of concrete of a given mix proportion is seriously affected by the degree of its compaction. It is therefore important that the consistency of the mix is such that the concrete can be transported, placed and finished sufficiently easily and without segregation. A concrete satisfying these conditions is said to be workable. Workability is a physical property of the concrete depending on the external and internal friction of the concrete matrix; internal friction being provided by the aggregate size and shape and external friction being provided by the surface on which the concrete comes into contact with. Consistency of concrete is another way of expressing workability but it is more confined to the parameters of water content. Thus concrete of the same consistency may vary in workability. One test which measures the consistency of concrete is the slump test. It does not measure the workability of concrete but it is very useful in detecting variations in the uniformity of a mix of given nominal proportions. Mixes of stiff consistency have zero slump. In this dry range no variation can be detected between mixes of different workability. In a lean mix with a tendency to harshness a true slump can easily change to the shear slump or even to collapse. Different values of slump can be obtained from different samples of the same mix. Despite the limitations, the slump test is very useful on site as a check on the day-today or hour-to-hour variations in the materials being fed into the mixer. An increase in slump may mean, for instance, that the moisture content of aggregate has unexpectedly increased; another cause would be a change in the grading of aggregate, such as a deficiency in sand. Too high or too low a slump gives immediate warning and enables the mixer operator to remedy the situation

Recent concrete once unsupported can flow to the perimeters and sinking tall can happen. This vertical settlement is thought as slump.

The workability (ease of blending, transporting, putting and compaction) of concrete depends on condition of concrete (consistency) i.e., water content still as proportions of fine mixture to coarse mixture and mixture to cement quantitative relation.

The slump check that may be a trial is merely associate approximate live of consistency shaping ranges of consistency for many sensible works. This check is performed by filling recent concrete within the mould and live the settlement i.e., slump.

The check measures consistency of concrete in this specific batch. It's performed to ascertain consistency of freshly created concrete. Consistency refers to the convenience with that concrete flows. it's accustomed indicate degree of condition.

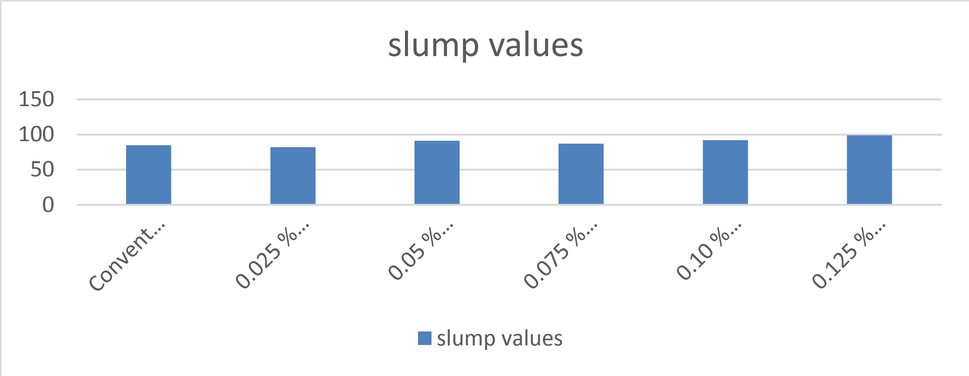
Consistency affects workability of concrete. That is, wetter mixes square measure additional practicable than drier mixes, however concrete of identical consistency might vary in workability. The check is additionally accustomed confirm consistency between individual batches.

The check is widespread attributable to the simplicity of equipment used and straightforward procedure. Sadly, the simplicity of the check usually permits a good variability within the manner during which the check is performed. The slump check is employed to confirm uniformity for various batches of concrete underneath field conditions and to establish the consequences of plasticizers on their introduction. In India, this check is conducted as per IS specification.

TABLE-01- SLUMP CONE TEST RESULTS

% of jaggery and sugar cane ash	Slump values
Conventional mix(35)	85
0.025 % admixture+10% ash	82
0.05 % admixture+15% ash	91
0.075 % admixture+20% ash	87
0.10 % admixture+25% ash	92
0.125 % admixture+30% ash	99

GRAPH-01- SLUMP CONE TEST RESULTS



2.2 COMPACTION FACTOR TEST

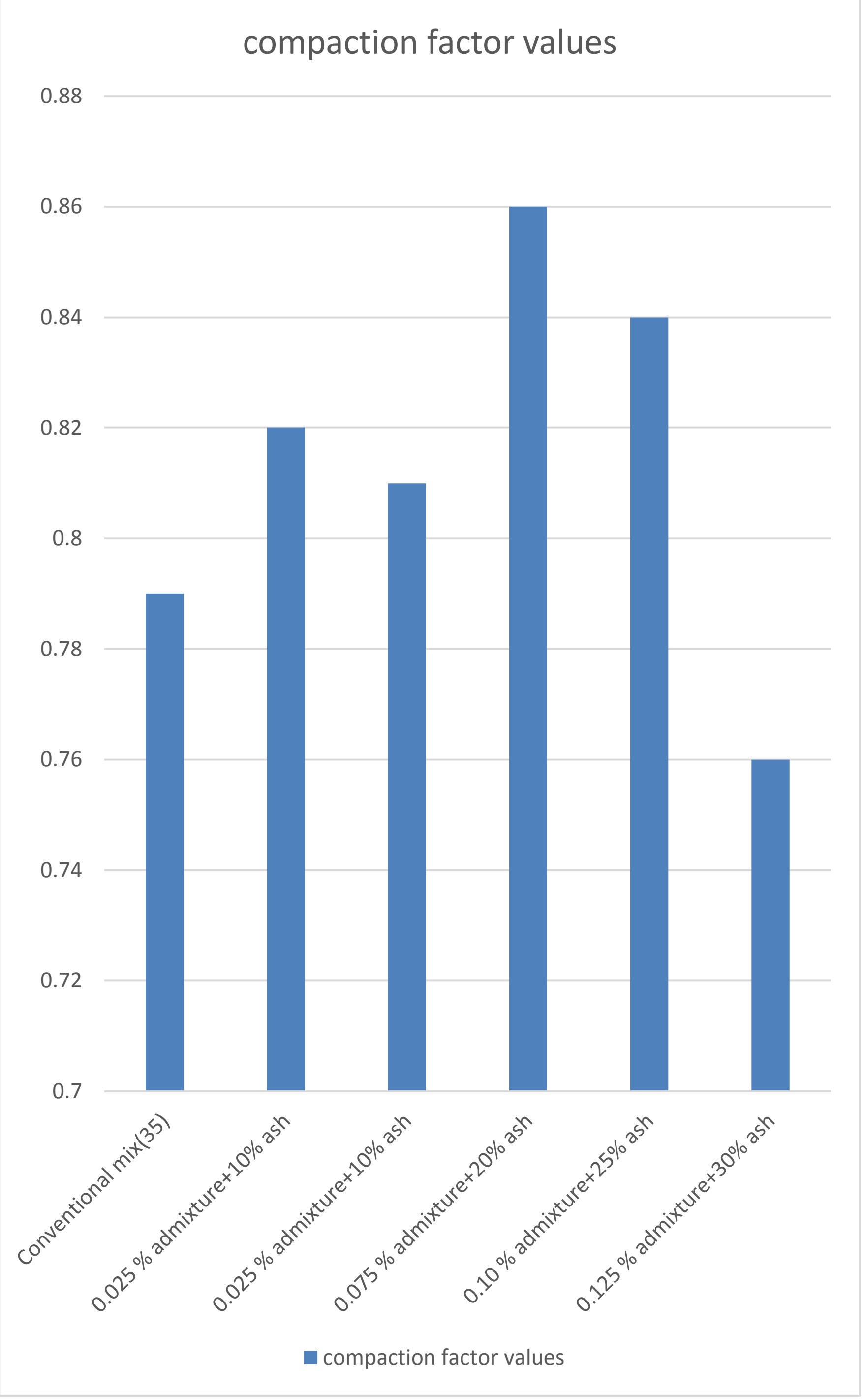
Scope and Significance Compaction factor test is adopted to determine the workability of concrete, where nominal size of aggregate does not exceed 40mm, and is primarily used in laboratory. It is based upon the definition, that workability is that property of the concrete which determines the amount of work required to produce full compaction. The test consists essentially of applying a standard amount of work to standard quantity of concrete and measuring the resulting compaction. To find the workability of freshly prepared concrete, the test is carried out as per specification of IS: 1199-1959. Workability gives an idea of the capability of being worked, i.e., idea to control the quantity of water in cement concrete mix to get uniform strength. It is more sensitive and precise than slump test and is particularly useful for concrete mixes of low workability. The compaction factor (C.F.) test is able to indicate small variations in workability over a wide range.

TABLE-02- COMPACTION FACTOR TEST RESULTS

% of jaggery and sugar cane ash	Compaction factor values
Conventional mix(35)	0.79
0.025 % admixture+10% ash	0.82
0.05 % admixture+15% ash	0.81
0.075 % admixture+20% ash	0.86

0.10 % admixture+25% ash	0.84
0.125 % admixture+30% ash	0.76

GRAPH-01- SLUMP CONE TEST RESULTS



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2.3 COMPRESSION TEST ON CONCRETE CUBES

The determination of the compressive strength of concrete is very important because the compressive strength is the criterion of its quality. Other strength is generally prescribed in terms of compressive strength. The strength is expressed in N/mm2. This method is applicable to the making of preliminary compression tests to ascertain the suitability of the available materials or to determine suitable mix proportions. The concrete to be tested should not have the nominal maximum size of aggregate more than 20mm test specimens are either 15cm cubes or 15cm diameter used. At least three specimens should be made available for testing. Where every cylinder is used for compressive strength results the cube strength can be calculated as under. Minimum cylinder compressive strength = 0.8 x compressive strength cube (10 cm x 10 cm) The concrete specimens are generally tested at ages 14 days and 28 days. The cubes are generally tested at 14 & 28 days unless specific early tests are required, for example to remove a concrete shutter safely prior to 14 days. Usually 1 cube will be tested 2 cubes at 28 days, however this may vary depending of the requirements, check the design first. The cubes are removed from the curing tank, dried and grit removed. The cubes are tested using a calibrated compression machine. This can be carried out internally by competent personnel or by a certified test house. The cubes are tested on the face perpendicular to the casting face. The compression machine exerts a constant progressing force on the cubes till they fail, the rate of loading is 0.6 ± 0.2 M/Pas ($N/mm^2/s$). The reading at failure is the maximum compressive strength of the concrete. BS EN 12390-2: 2009 / BS EN 12390-3:2009. The concrete minimum compressive strength will be specified by the client/designer in a specific format

All specimens shall be tested inside one hour of removal from the water or mist chamber, while they're still wet. simply before commencing the static modulus of physical property check, the compressive strength of the wrought specimen shall be determined from the 2 normal a hundred and fifty millimeter cubes of identical batch, created and cured underneath similar conditions because the specimen. The cubes shall be crushed and therefore the concrete strength born-again to equivalent cylinder strength by multiplying the cube strength by an element of zero.8. For concrete cores, the compressive strength shall be determined in accordance with the procedure given in Section fifteen of this normal.

Figure 02-CTM

TABLE-03- COMPRESSIVE STRENGTH TEST RESULTS FOR 7 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	7 days compressive strength n/mm2
Conventional mix(35)	0.45	18.92
0.025%admixture+10% ash	0.45	19.04
0.05%admixture+15% ash	0.45	20.05
0.075%admixture+20% ash	0.45	18.56
0.10%admixture+25% ash	0.45	17.1
0.125%admixture+30% ash	0.45	16.56

GRAPH-03 COMPRESSIVE TEST RESULTS FOR 7 DAYS

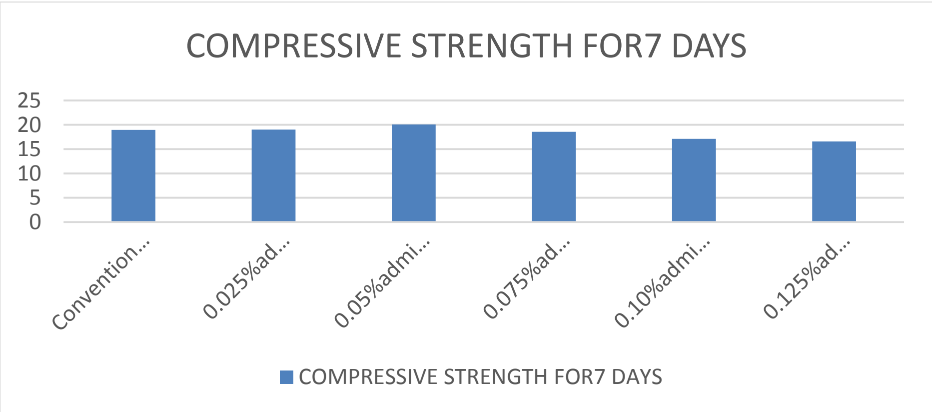


TABLE-04- COMPRESSIVE STRENGTH TEST RESULTS FOR 28 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	28 days compressive strength n/mm2
Conventional mix(35)	0.45	35.281
0.025%admixture+10% ash	0.45	36.15
0.05%admixture+15% ash	0.45	37.05
0.075%admixture+20% ash	0.45	34.56
0.10%admixture+25% ash	0.45	33.01
0.125%admixture+30% ash	0.45	31.01

GRAPH-04 COMPRESSIVE TEST RESULTS FOR 28 DAYS

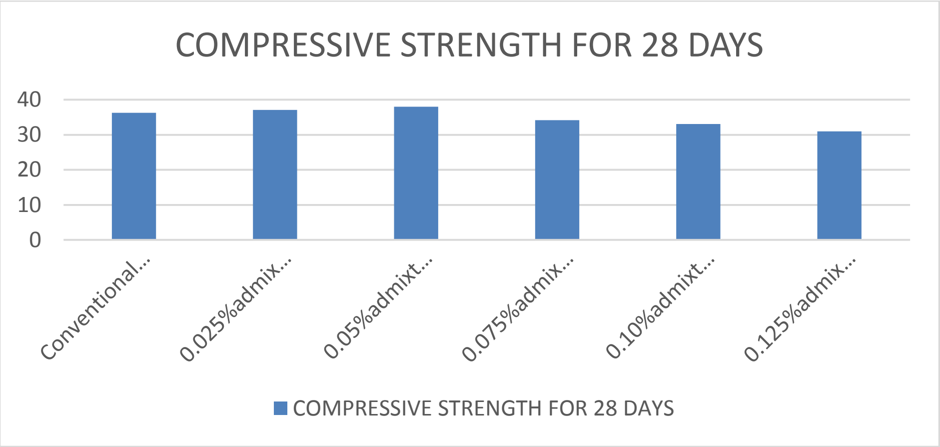
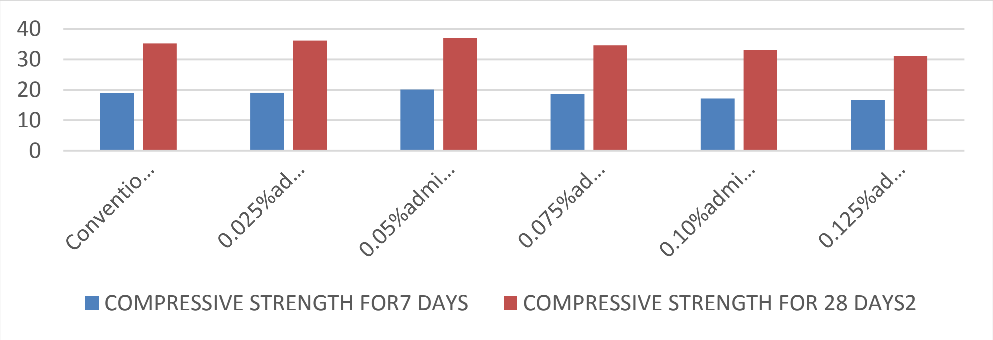


TABLE-05- COMPARISION OF COMPRESSIVE STRENGTH TEST RESULTS FOR 7 AND 28 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	7 days compressive strength n/mm2	28 days compressive strength n/mm2
Conventional mix(35)	0.45	18.92	35.281
0.025%admixture+10% ash	0.45	19.04	36.15
0.05%admixture+15% ash	0.45	20.05	37.05

0.075%admixture+20% ash	0.45	18.56	34.56
0.10%admixture+25% ash	0.45	17.1	33.01
0.125%admixture+30% ash	0.45	16.56	31.01

GRAPH-05 - COMPARISION OF COMPRESSIVE STRENGTH TEST RESULTS FOR 7 AND 28 DAYS



2.4 SPLIT-TENSILE TEST

It is the standard test, to determine the tensile strength of concrete in an indirect way. This test could be performed in accordance with IS : 5816-1970.

A standard test cylinder of concrete specimen (300 mm X 150mm diameter) is placed horizontally between the loading surfaces of Compression Testing Machine (Fig-4). The compression load is applied diametrically and uniformly along the length of cylinder until the failure of the cylinder along the vertical diameter. To allow the uniform distribution of this applied load and to reduce the magnitude of the high compressive stresses near the points of application of this load, strips of plywood are placed between the specimen and loading platens of the testing machine. Concrete cylinders split into two halves along this vertical plane due to indirect tensile stress generated by poison’s effect.

Concrete is robust in compression however weak in tension. Tension stresses square measure possible to develop in concrete attributable to drying shrinkage, oxidation of reinforcement, gradient etc. In concrete road block this tensile stresses square measure developed attributable to wheel loaded and volume changes in concrete square measure offered to see this. Split check is one among the indirect ways offered to search out the enduringness.

The enduringness of concrete is one among the essential and vital properties. cacophonous enduringness check on concrete cylinder may be a methodology to see the enduringness of concrete. The concrete is extremely weak in tension attributable to its brittle nature and isn't expected to resist the direct tension. The concrete develops cracks once subjected to tensile forces. Thus, it's necessary to see the enduringness of concrete to see the load at that the concrete members might crack.

Sampling of Concrete Cylinders:

The cylinder mould shall is of metal, 3mm thick. every mould is capable of being opened longwise to facilitate the removal of the specimen and is given a method of keeping it closed whereas in use. The mean internal diameter of the mould is fifteen cm ± zero.2 millimeter and therefore the height is thirty +/- zero.1 cm. every mould is given a metal base plate mould and base plate ought to be coated with a skinny film of mould oil before use, so as to stop adhesion of concrete.

Figure 02-CTM

TABLE-06-SPLIT TENSILE STRENGTH TEST RESULTS FOR 7 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	7 days split tensile strength n/mm2
Conventional mix(35)	0.45	2.174
0.025%admixture+10% ash	0.45	2.181
0.05%admixture+15% ash	0.45	2.23
0.075%admixture+20% ash	0.45	2.154
0.10%admixture+25%	0.45	2.06

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ash		
0.125%admixture+30% ash	0.45	2.03

GRAPH-06 SPLIT TENSILE TEST RESULTS FOR 7 DAYS

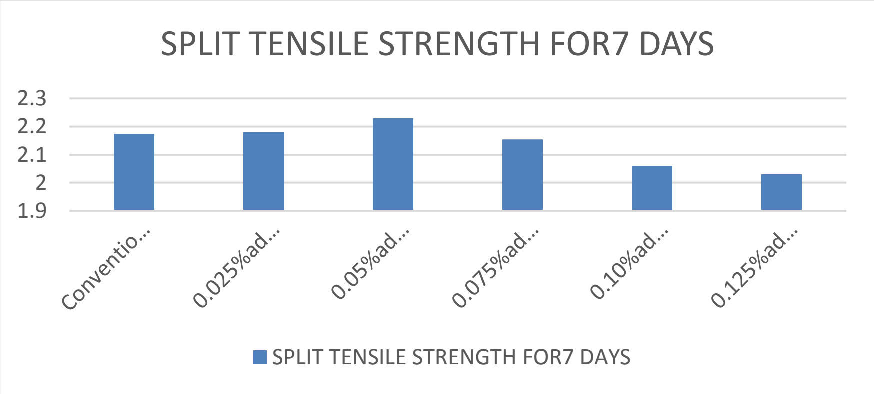

TABLE-07- SPLIT TENSILE STRENGTH TEST RESULTS FOR 28 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	28 days compressive strength n/mm2
Conventional mix(35)	0.45	2.96
0.025%admixture+10% ash	0.45	3.006
0.05%admixture+15% ash	0.45	3.043
0.075%admixture+20% ash	0.45	2.293
0.10%admixture+25% ash	0.45	2.872
0.125%admixture+30% ash	0.45	2.78

GRAPH-07 SPLIT TENSILE TEST RESULTS FOR 28 DAYS

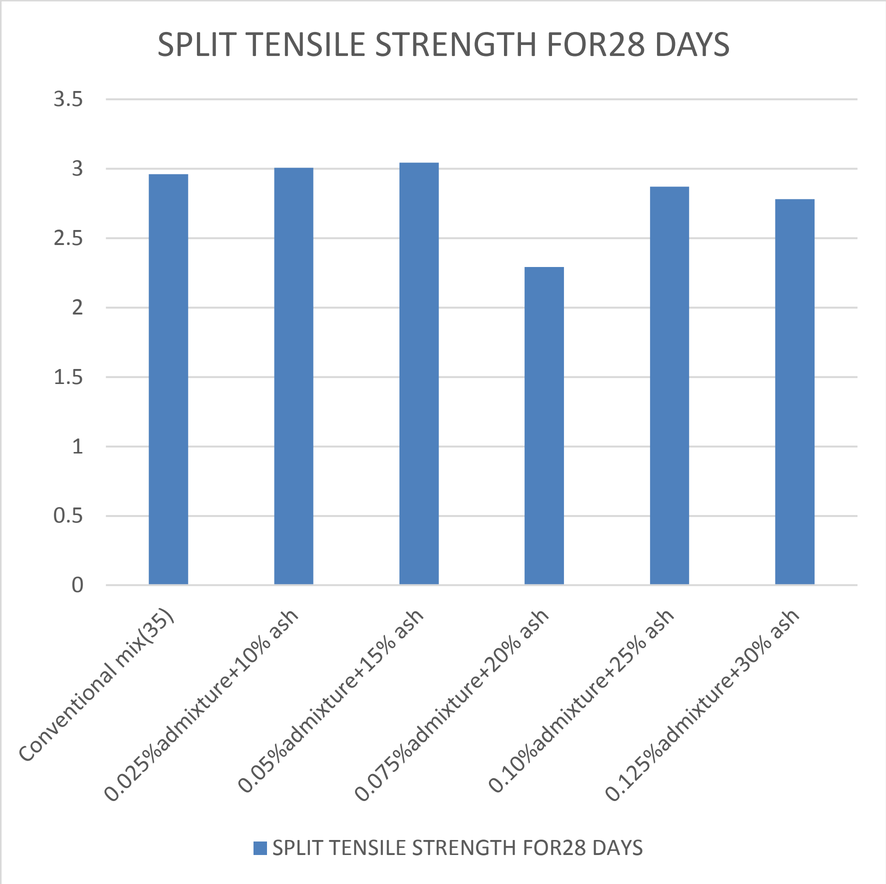

TABLE-08- COMPARISION OF SPLIT TENSILE STRENGTH TEST RESULTS FOR 7 AND 28 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	7 days compressive strength n/mm2	28 days compressive strength n/mm2
Conventional mix(35)	0.45	2.174	2.96
0.025%admixture+10% ash	0.45	2.181	3.006
0.05%admixture+15% ash	0.45	2.23	3.043
0.075%admixture+20% ash	0.45	2.154	2.293
0.10%admixture+25% ash	0.45	2.06	2.872
0.125%admixture+30% ash	0.45	2.03	2.78

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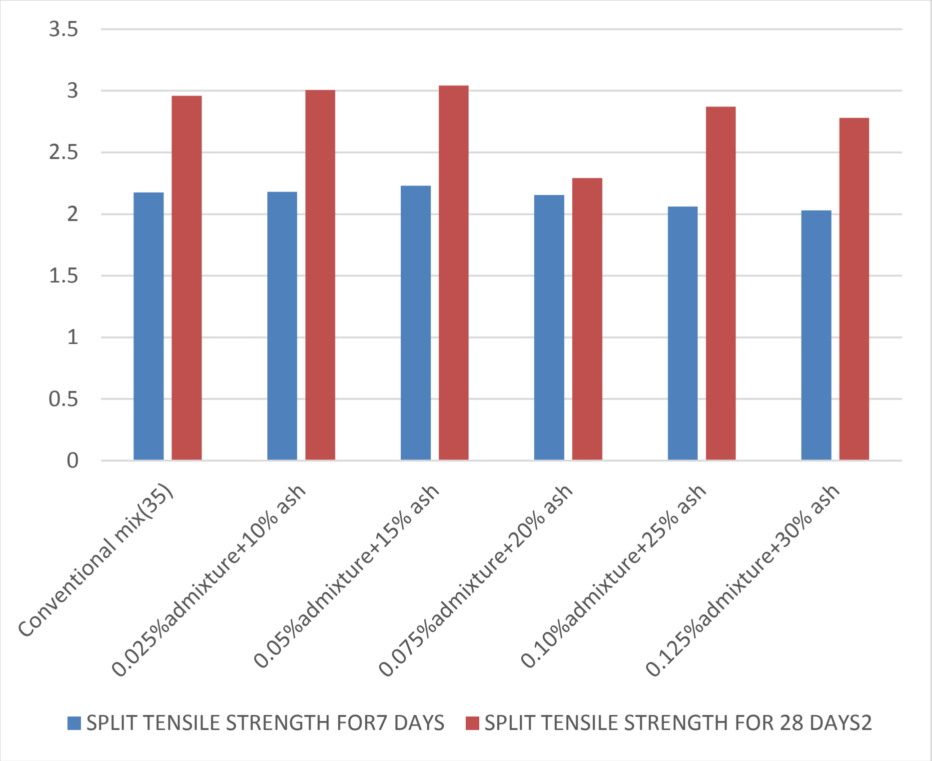
GRAPH-08 - COMPARISION OF SPLIT TENSILE STRENGTH TEST RESULTS FOR 7 AND 28 DAYS



2.5 FLEXURAL STRENGTH OF CONCRETE

The flexural strength would be the same as the tensile strength if the material were homogeneous. In fact, most materials have small or large defects in them which act to concentrate the stresses locally, effectively causing a localized weakness. When a material is bent only the extreme fibers are at the largest stress so, if those fibers are free from defects, the flexural strength will be controlled by the strength of those intact 'fibers'. However, if the same material was subjected to only tensile forces then all the fibers in the material are at the same stress and failure will initiate when the weakest fiber reaches its limiting tensile stress. Therefore, it is common for flexural strengths to be higher than tensile strengths for the same material. Conversely, a homogeneous material with defects only on its surfaces (e.g., due to scratches) might have a higher tensile strength than flexural strength.

If we don't take into account defects of any kind, it is clear that the material will fail under a bending force which is smaller than the corresponding tensile force. Both of these forces will induce the same failure stress, whose value depends on the strength of the material.

Figure 03-FLEXURAL SET-UP

TABLE-09- FLEXURAL STRENGTH TEST RESULTS FOR 7 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	7 days flexural strength n/mm2
Conventional mix(35)	0.45	3.044
0.025%admixture+10% ash	0.45	3.054
0.05%admixture+15% ash	0.45	3.134
0.075%admixture+20% ash	0.45	3.01
0.10%admixture+25% ash	0.45	2.89
0.125%admixture+30% ash	0.45	2.84

GRAPH-09 FLEXURAL TEST RESULTS FOR 7 DAYS

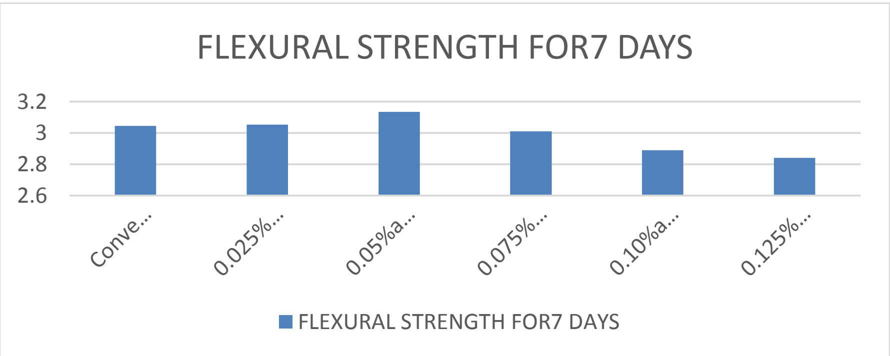


TABLE-10- FLEXURAL STRENGTH TEST RESULTS FOR 28 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	28 days flexural strength n/mm2
Conventional mix(35)	0.45	4.15
0.025%admixture+10% ash	0.45	4.20
0.05%admixture+15% ash	0.45	4.26
0.075%admixture+20% ash	0.45	4.11
0.10%admixture+25% ash	0.45	4.02
0.125%admixture+30% ash	0.45	3.89

GRAPH-10 FLEXURAL TEST RESULTS FOR 28 DAYS

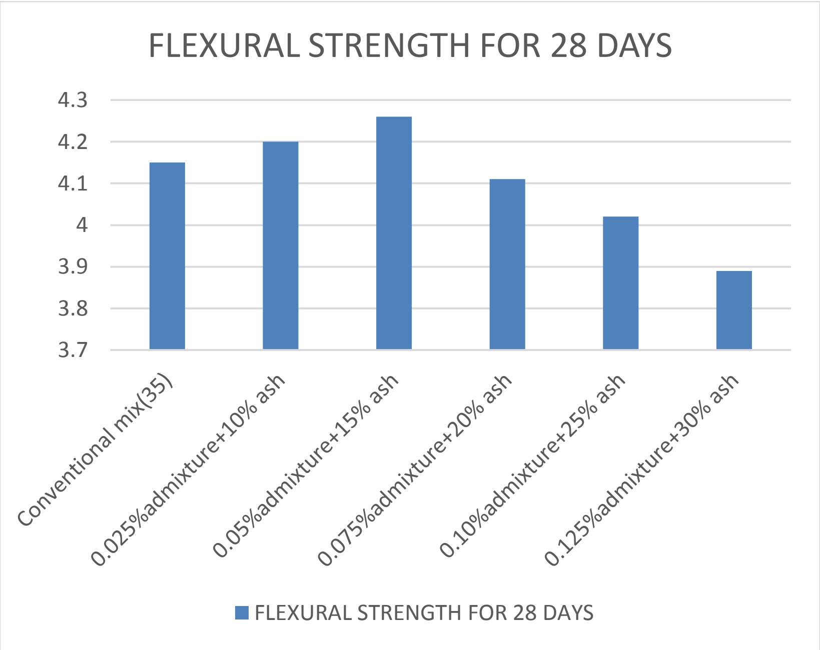
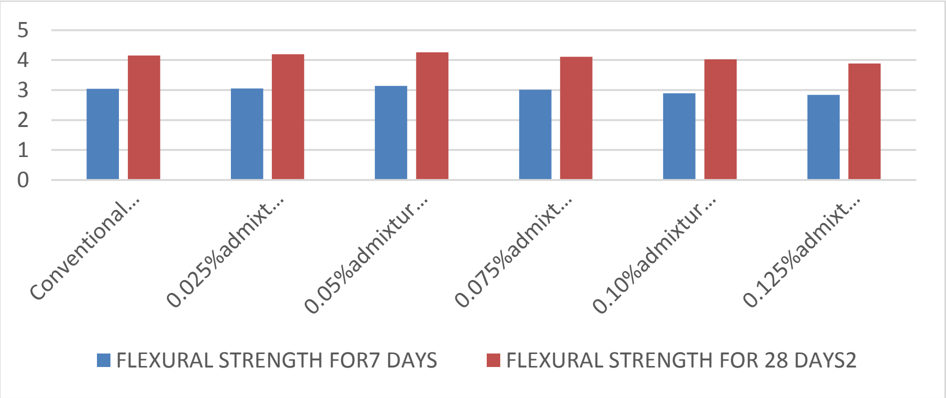


TABLE-11- COMPARISION OF FLEXURAL STRENGTH TEST RESULTS FOR 7 AND 28 DAYS

%of admixture&%of sugar cane ash added	w/c ratio	7 days compressive strength n/mm2	28 days compressive strength n/mm2
Conventional mix(35)	0.45	3.044	4.15
0.025%admixture+10% ash	0.45	3.054	4.20
0.05%admixture+15% ash	0.45	3.134	4.26
0.075%admixture+20% ash	0.45	3.01	4.11
0.10%admixture+25% ash	0.45	2.89	4.02
0.125%admixture+30% ash	0.45	2.84	3.89

GRAPH-11 - COMPARISION OF FLEXURAL STRENGTH TEST RESULTS FOR 7 AND 28 DAYS



3.CONCLUSION

Workability increases when the dosage of admixture was increased. Compressive strength of concrete enhances when dosage of admixture is increased. Concrete with Jaggery as admixture, gives better strength values than the Sugar. Segregation and bleeding was very less due to the usage of these admixtures. Setting time of the concrete increases as the dosage of admixture was increased. When compared to sugar cane ash the optimum percentage that it can be replaced is 15% with cement to increase compressive strength of concrete. The compressive strength of concrete is increased by 4.15 % for 15% replacement of sugar cane ash. The split tensile strength and flexural of concrete increased for 15% replacement of sugar cane ash. There is no much more increase in the compressive strength , split tensile and flexural strength of concrete for ash replacement for 28 days. Strength of the concrete improved with little extra cost and utility in specified situations.

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