ISSN 2277 – 5528
Impact Factor- 4.015

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

EFFECT OF SUGER AND JAGGERY (MOLASSES) ON STRENGTH PROPERTIES OF CONCRETE

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ABSTRACT

This paper emphasizes the effect of Sugar and Jaggery on strength properties of concrete. The experimentation has been carried out for the strength properties of concrete using Sugar and Jaggery as admixtures into the concrete composition. Based on the literature, the main function for usage of Sugar and Jaggery is to extend the initial setting time of concrete. Usually these type of admixtures used in the special cases like big piers and long piles. Three different percentages of admixtures (Sugar and Jaggery) are chosen in the experimentation as 0, 0.05 and 0.10% by weight of cement. Finally it was concluded that workability and compressive strength of concrete when admixtures like Sugar and Jaggery mixing(added) into the concrete composition.This paper gives special importance or value to the effect of sugar on strength of concrete. This experiment determines the effect of admixtures (sugar) on the compressive strength of concrete block.Based on books and literature the main function of sugar to increase the initial setting time of concrete.

***Keywords**: Admixtures, Compressive strength, Jaggery(*Molasses), *Sugar, Workability, Water reducing.*

I. INTRODUCTION

Concrete is an inevitable material in human beings life, because of its superior characteristics like strength and durability, but in certain situations it be used in places because setting time of concrete. Retarders are used in the concrete composition to improve the setting time and increase the temperature of composition with diff. type of admixture.Concrete made with admixtures like sugar and jaggery(molasses)can be utilised in particular situations. Usage of these admixtures will mimize the segregation and bleeding. Sugar is the carbohydrate, a substance of carbon, oxygen and hydrogen. Jaggery is made from the product of sugar cane. So, both are useful to mix as an admixtures in the concrete composition.Based on the experimental results, it was replacement ratio increases, workability and strength value were increased [i]. White sugar was used from 0 to 1.5 % by weight of cement in the concrete . Compressive strength was improved that the , but maximum strength was obtained at 0.065% for 28 days [ii]. In the process of manufacturing the The compressive strength was increased by 18 and 8% respectively [iii]. Molasses has been procured from three different sugar industries and added two percentages of 0.6and 0.9% by weight of cement into the concrete as admixture. Setting time was increased when dosage increases. Similar types of trends observed in the compressive strength of concrete with 0.5% molasses based admixture [iv]. Setting of cement extended due to the incorporation of sugar by weight of cement up to certain extent of 0.20%, exceeding this limit of incorporation, it has been acted as accelerator up to 0.4% and the optimum percentage of sugar added into the concrete was 0.20% [v]. 23% of SCBA added into the clinker, which resulted maximum compressive strength of mortars among 0 - 45% of SCBA added in the clinker [vi]. 28.20 N/mm2 was recorded and it was an appreciable strength development, when sugar was added as the admixture. This was 16.9% higher than control value [vii].

II. LITERATURE REVIEW

Bazid khan (2006) He added sugar& jaggery as a admixture in cement paste into three different type of cements. The test result show that the effects of sugar & jaggery on setting time of cement paste depends upon the dosages and different type of cements are used. According to his investigation the type of cement it accelerated the initial setting time and retarded the final setting time when dosages higher than 0.25% were used.(1).G.L.Oyekan(2008) Successful worked on improving the compressive strength of concrete block by the addition of sugar. 0.5% sugar content (by weight of cement) increased the strengths of the blocks by nearlys20% at 28 days. At 0.4% sugar content (by weight of cement) the 28 day strength of the blocks was increased by only 8% but the 14day strengths of the blocks was increased by 57%(2).Akogu Elijah Abalaka (2012) a successful work on sugar at concentration of 0.08%

by weight of sugar content were taken on the cement past with C53 concrete curing at 3,7,14,and 28 days was investigated by use of ordinary Portland cement. The compressives strength test results show the marginal strength gains peaks at 12% at 3 days at 0.065% sugar content(3).

III. METHEDOLOGY

For developed concrete mix, it is important to select proper evaluate their properties and understand the interaction among different materials. Concrete will normalcontain not only Cement and Aggregate, Water, but also Cementing Materials.

- Cement.
- Sand (fine aggregates).
- Coarse Aggregates.
- Suger.
- Jaggery(Molasses)

Table 1- Cement Properties

Sr. No.	Description of Test	Results	As per IS: 12269-1987
01	Fineness of cement (residue on IS sieve No. 9)	3 %	> 10%
02	Specific gravity	3.06	3.15
03	Standard consistency of cement	31.5 %	-
04	Setting time of cement a) Initial setting time b) Final setting time	 37minute 460minute	 > 30 minute < 600 minute
05	Soundness test of cement (with Le-Chatelier's mould)	8mm	10 mm
06	Compressive strength of cement: a) 3 days b) 7 days	 44.75 N/mm2 54.60 N/mm2	 > 27 N/mm2 > 37 N/mm2

Table 2- Physical properties of Fine Aggregate (sand).

SrNo.	Property	Results
01	ParticleShape,Size	4.75mm
02	FinenessModulus	2.86
03	Siltcontent	3.00%
04	SpecificGravity	2.63
05	Water absorption	1.1%
06	Bulking of sand	4.20%
07	Bulk density	1787 Kg/m3
08	Surface moisture	___--

Table3-PhysicalPropertiesofCoarseAggregate.

SrNo.	Property	Results
01	Particle Shape, Size	Angular, 20mm,10mm down
02	Fineness Modulus of 20mm aggregates	7.6
03	Specific Gravity	2.67
04	Water absorption	0.52%
05	Bulk density of 20mm aggregates	1607 Kg/ mm3
06	Bulk density of 10mm aggregates	1588 Kg/mm3
07	Surface moisture	-----

ISSN 2277 – 5528
Impact Factor- 4.015

IV. OBJECTIVESAND SCOPEOF INVESTIGATION

The purpose of this study is to investigate the influence of sugar, jaggery and on properties of concrete. Workability and compressive strength being very important properties of concrete, it is therefore to improve such properties, admixtures is generally mixed into concrete. These admixtures while mixed into concrete at prescribed dosage they tends to change the properties of concrete. The Sugar and Jaggery are the admixtures used to change the properties of concrete. The basic reason of adding of sugar and jaggery as admixtures is while they are added, the adsorption of sugar and jaggery acts as thin layer over the cement particles and it slows down the hydration process. Formation of calcium ions will increase the solubility and discouraging the formation of calcium hydroxide. By this reason setting property of concrete as well as strength of concrete has been improved.

V. MATERIALS

Cement

53 Grade ordinary Portland cement conforming to IS: 12269 was used. The Specific gravity of the cement was 3.13, the initial and final setting times were found as 91 minutes and 285 minutes respectively.

Fine Aggregate

available in river sand passing through 4.75 mm IS Sieve was used. The specific gravity of the sand was found as 2.64 and confirming to zone III of IS 383-1970.

Coarse Aggregate

Crushed granite aggregate available from locally source has been used. The size of coarse aggregate was 20mm and its specific gravity was 2.69.

Admixtures

Sugar is used adding in the concrete. White crystalline solid readily soluble in water and available in market was used in the other experimentation work. Sugar and jaggery was added in concrete composition with three different dosages as 0, 0.06 and 0.15% by weight of cement.shows the sample of Sugar and Jaggery in solid form.

Casting& Curing

Two different sets of specimens are prepared using design mix in the first set, the specimen are casted by varying percentage of replacement of cement by Rice husk ash starting from 0 to 25% with increment of 5% by weight of cement and they represented as 5%, 10%, 15%, 20% respectively. In second set the former procedure is followed, I have selected one of the above sample which give the optimum strength and then vary the sugar molasses at 0.40%, 0.80%, 1.20%, 1.60%, 2.0% by weight of material is added they are designated as cubes with size 150mm X 150mmX 150mm, are prepared. The cube are demoulded after 24 hours from casting and kept in the water tank for 28 days.

Fig: 1 Sample of jaggery molasses

Mix proportion

Nominal proportions chosen for the concrete mix of m20 grade as per IS 10262-1984 and it is 0.50: 1:00: 1.50:3.00 (W: C: FA: CA) by weight. For better workability, aggregates were used as 50 % of 20 mm and 40 % of 12.5mm and fine aggregate was used in the concrete are used.

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VI. OVERVIEW

In this present work, the main object is to resolve the behavior of concrete in compression by adding(mixing) Sugar and Jaggery(molasses) as admixtures into the concrete. Sugar and Jaggery were added by weight of cement as 0, 0.050 and 0.10% into the concret. Workability of concrete was study by performing the slump cone test and compaction factor test. For every amount of dosage of admixture, slump cone and compaction factor tests were workability of concrete. For each dosage of admixture, six number of cube specimens were casted and tested for the strength characteristics. Among these six numbers of cube specimens were tested for find out the 7 days compressive strength and further six specimens were used for the 28 days compressive strength.

Overview of Workability

The workability of the fresh concrete is a composite property. IS: 6461 (Part-VII) – 1976 defines workability as the property of freshly mixed concrete which determines the ease and homogeneity with which it can be mixed, placed, compacted and finished. According to the IS 1199-1960, workability of fresh concrete has been performed. Workability of concrete can also depend on the type structure, thickness of structural and place of casting.

Fig: 2 Slump cone and collapse of concrete after lifting.

Fig:3 Compaction factor apparatus and weighing of partially weighed concrete

Over view of Compressive strength

six cube specimens of each percentage (0.0, 0.05 and 0.1%) were casted according to the nominal mix proportion and the size of cube specimen was 0.15 m x 0.15 m x 0.15 m. According to the IS: 10086-1982,six are cube moulds were used in the experimental process. Specimens were casted in cube mould and filled with concrete in 3 layers. Hand compaction was applied with tamping rod. Finished top surface smoothly and de-molded after 24 hrs. Demoulding of cube specimen was after 24 hrs for specimens casted with admixture of 0.06% and 0.10% because of setting time. The specimens were kept into the curing tank for curing @ tempture 27±5° for a period of 28days. During the experimentation of casting, it was observed lower of bleeding and segregation.

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Impact Factor- 4.015

Fig: 4 Casted cube specimens.

VII. TEST PROCEDURE

Test procedure of Workability

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- Slump cone test
- Compaction factor test

Slump Cone Test

Slump test is most commonly used method of measuring consistency of concrete which can be employed either in laboratory at the site of work. It is not a suitable method for of very Wet& Dry concrete. It does not measure all the factors contributing to workability, nor it is always representative of place ability of concrete from batch to batch Slump indicates characteristics of concrete slumps evenly it is known as true slump. If one half of the cone slides down, it is called shear slump, the slump value is measured as the difference is between the height of mould and average value of the subsidence as shown in Shear slump also indicates that the concrete is non-cohesive and shows characteristics of segregation.

Compaction Factor Test

The compaction factor test is used in the experimental work but it can also be used in the field. It is more precise and sensitive to the slump. This test works on the principle of determining the degree of compaction achieved by a standard amount of work done by allowing the concrete to fall through a standard height. The degree of compactor factor is measure by density ratio i.e. ratio of density actually achieved in the test to identify of same concrete fully compacted this test measure the inherent characteristics of the concrete which relates very close to the workability requirements of concrete and such it is one of the good tests to depict the workability of concrete.

It's weight is measured, the weight is known as weight of partially compacted concrete, the emptied the cylinder and then refilled with the concrete from the same sample in layer The layers are tamped by tamping rod uniformly giving 25 blows. The top surface of fully compacted concrete is then carefully and weighed, the weight is known as fully compacted concrete. C.F = Weight of partially compacted concrete.

Test procedure of Compressive strength:

Remove the cube specimens from the curing tank after period of 7 days and 28 days and drying in shade for about some time. Take the weight of the each cube and place the specimen opposite direction of casting in 2000 kN CTM. Apply load uniformly and note down the ultimate load. Testing of cube specimen has been shown in Fig 5.0.

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Fig: 5Testing of cube specimen.

VIII. RESULTS & DISCUSSIONS

Effect of molasses on setting time of concrete

Consistency of plain cement paste is to know that the 36.00%. Based on this consistency value, initial and Final setting time were cal.For plain cement as per IS 4031-1989. Initial and final setting time of cement is 25 min and 7hr 40min respectively. The same test repeated after 0.2, 0.4, 0.6, 0.8 and 1.0 percentage of molasses added to cement by its weight. At each time the setting time gradually get increased. The following table shows the effect of molasses on setting time of concrete.

Fig.6Test for setting time of cement

Table 7: Effect of molasses on initial and final setting time of concrete

S.No	% of Molasses	Initial Settling Time (Hr:min)	Initial Settling Time (Hr:min)
01	0	00:20	07:45
02	0.2	00:22	07:45
03	0.4	00:26	08:20
04	0.6	00:28	13:00
05	0.8	00:30	16:30
06	1.0	00:34	21:30

Workability of concrete with Sugar and Jaggery(Molasses)

Concrete has been prepared with mixing of admixtures (Sugar and Jaggery) with three different percentages as 0 %, 0.10% and 0.20%.Based on the experimental results, as the percentage(%) of admixtures increased,both are the test slump and compaction factor also increased. Addition of Sugar and Jaggery to the concrete greatly influenced the setting property and clear collapse of slump witnessed during the experimentation. Setting of cube specimens after 24 hrs was difficult.

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Impact Factor- 4.015

Table4: Workability of concrete with Sugar andMolasses as admixture.

S.NO	Admixture	% of Admixture	Slump value in mm	Compaction Factor
01	Suger	0	100	0.94
02	Suger	0.05	160	0.95
03	Suger	0.1	200	0.96
04	Molasses	0	100	0.94
05	Molasses	0.05	150	0.925
06	Molasses	0.1	180	0.95

Concrete specimens with sugar as admixture exhibited better workability than jaggery. Fig 6 and 7 give the graphical representation of slump and compaction factors.

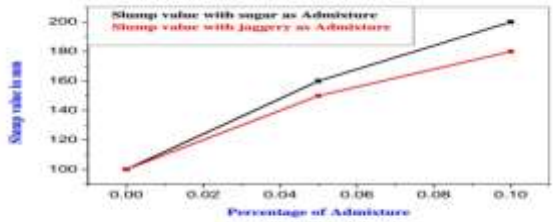

Fig 6: Slump value of concrete with added Admixtures

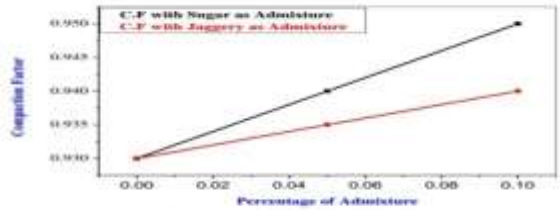

Fig 7: Compaction Factor of concrete with added Admixtures.

Compressive strength of concrete with sugar and Molassesas admixtures

Based on the test results, as percentage(%) of admixture increases from 0 to 0.10% the compressive strengthof concrete increased. Maximum strength of concrete was workability of concrete and it can beachieved by the high degree of workability. The only reason for improve the of strength was bonding of concrete& admixture.

Table 5: Compressive strength of concrete with Sugar added as Admixture.

S.R No	Percentage of admixture	Density of concrete in kg/m3	7days compressive strength in MPA	28days compressive strength in MPA
01	0	2456.8	26.84	35.45
02	0.05	2475.6	29.45	37.45
03	0.1	2492.4	31.15	39.64

Table 6: Compressive strength of concrete withMolassesadded as Admixture.

S.R No	Percentage of admixture	Density of concrete in kg/m3	7days compressive strength in MPA	28days compressive strength in MPA
01	0	2456.8	26.84	35.45
02	0.05	2475.6	30.45	38.45
03	0.1	2492.4	32.15	41.64

IX. CONCLUSION

Collapse of Slump was observed in both the admixtures at a dosage of 0.1%. Workability increased when the amount of dosage of admixture was increased. Compressive strength of concrete enhanced when amount of dosage

of admixture was increased. Concrete with Jaggery as admixture, has given high strength values than the Sugar. Segregation and bleeding was very less amount of due to the usage of these admixtures. Setting time of the concrete increased as the amount dosage of admixture was increased. Strength of the concrete with little extra cost and minimize in specified situations. Concrete with Jaggery as admixture, gives better strength values than Sugar.

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