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EFFECT OF SUGAR AND JAGGERY ON WORKABILITY AND COMPRESSIVE STRENGTH OF CONCRETE

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ABSTRACT

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. Concrete made with admixtures like sugar and jaggery can be utilized in particular situations. Usage of these admixtures will decrease the segregation and bleeding. The paper contents mix design of concrete by using sugar and jaggery as admixtures and comparative study of workability and compressive strength of concrete with conventional concrete.

Keywords: Admixtures, Compressive strength, Workability, Jaggery, Sugar.

I.INTRODUCTION

Cement concrete is a mixture of coarse aggregates, fine aggregate, cement and water in certain proportion so as to make a concrete of desired quality. Concrete is an inevitable material in the human beings life, because of its superior characteristics like strength and durability, but in certain situations it can't be used in all places because 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 an old Monuments in Gandikota at Kadapadist, where 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.

White sugar was used from 0 to 1% by weight of cement in the concrete preparation. Compressive strength was marginally improved, but maximum strength was obtained at 0.06% for 28 days. Setting of cement extended due to the incorporation of sugar by weight of cement up to certain extent of 0.15%, exceeding this limit of incorporation, it has been acted as accelerator up to 0.3% and the optimum percentage of sugar added into the concrete was 0.05%.

In the process of manufacturing the sandcrete brick of size 450mm x150mm x225mm, 10 and 0.2% of sugar was added by weight of cement into the brick manufacturing. The compressive strength was increased by 17 and 9% respectively

Molasses has been procured from three different sugar industries and added two percentages of 0.4 and 0.7% by weight of cement into the concrete as admixture. Setting time was increased when dosage increases. Similar types of trends were observed in the compressive strength of concrete with 0.4% molasses based admixture.
20% of SCBA added into the clinker, which resulted higher compressive strength of mortars among 0 - 40% of SCBA added in the clinker.

II. LITRATURE REVIEW

1. Bazid khan (2004) He added sugar as a admixture in cement paste into three different type of cements. The test result show that the effects of sugar on setting time of cement paste depends upon the dosages and different type of cements used. According to his investigation the one type of cement it accelerated the initial setting time and retarded the final setting time when dosages higher than 0.25% were used.

2. G. L. Oyekan (2007) Successful worked on improving the compressive strength of concrete block by the addition of sugar. 10% sugar content (by weight of cement) increased the compressives strengths of the blocks by nearlys 17% ats 28 days. At 0.2% sugar content (by weight of cement) the 28 – day strength of the blocks was increased by only 9% but the 14-day strengths of the blocks was increased by 56.6%.

3. Akogu Elijah Abalaka (2011) a successful work on sugar at concentration of 5% by weight of sugar content were taken on the cement past with C33 concrete curing at 3,7,14,and 28 days was investigated by use of ordinary Portland cement. The compressives strength test results show some marginal strength gains at all ages but peaks at 11.84% at 3 days at 5% sugar content.

4. Giridhar.V (2013) based on the test results, as percentage of admixture increases from 0 tos1% that compressive strength of concrete also increased. Maximums strength of concretes was related on workability of concrete and its can be achieved by high degrees of workability. The compressive strengths of concretes measured for both admixtures after 7 and 28 days. After 28 days, the percentage of variations between the ordinary concrete and concrete with 1% of sugar added as admixture was 12.0%.

III.OBJECTIVES

- To study effect on workability and compressive strength of concrete by using sugar as admixture
- To study effect on workability and compressive strength of concrete by using jaggery as admixture.

IV. MIX DESIGN FOR M20 GRADE

COMPRESSIVE STRENGTH REQUIRE IN FIELD	- 20MPA
MAXIMUM SIZE OF AGGREGATE	- 20mm
DEGREE OF QUALITY CONTROL	- Good
TYPE OF EXPLOSURE	- Mild
SPECIFIC GRAVITY OF CEMENT	- 3.15

SPECIFIC GRAVITY OF C.A. - 2.60

SPECIFIC GRAVITY OF F.A. - 2.60

COURSE AGGREGATE - 0.5%

FINE AGGREGATE - 1%

Table no. 1: Quantity of material for one block

SR. NO.	MATERIAL	QUANTITY
1	CEMENT	1.5 kg
2	COURSE AGGREGATE	2.25 kg
3	FINE AGGREGATE	4.5 kg
4	W/C RATIO	0.5

IV. MIX DESIGN

Nominal proportions chosen for the concrete mix of M20 grade as per IS 10262-1982 and it was 0.50: 1: 1.50:3.00 (W: C: FA: CA) by weight. For better workability, graded aggregates were used as 60 % of 20 mm and 40 % of 12.5mm and fine aggregate of zone II was used in the concrete preparation.

PREPARATIONS OF BLOCK:

In this present work, the main object is to resolve the behavior of concrete in compression by adding Sugar and Jaggery as admixtures into the concrete. Sugar and Jaggery were added separately by weight of cement as 0 and 1% into the concrete. For which cubes were casted to estimate the compressive strength of concrete. Workability of concrete was studied by performing the slump cone test. For every dosage of admixture, slump cone was performed to record the workability of fresh concrete. For each dosage of admixture, six number of cube specimens were casted and tested for evaluating the strength characteristics. Among these three numbers of cube specimens were tested for determining the 7 days compressive strength and further three specimens were used for determining the 28 days compressive strength.

For Workability:

The workability of fresh concrete is a composite property. It is difficult to define precisely all the aspects of the workability in a single definition. IS: 6461 (Part-VII) – 1973 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 1199-1959, workability of fresh concrete has been performed. Workability of concrete can also depend on the type structure, thickness of structural element and place of casting. For development of above said characteristics, it is necessary to add admixtures into the concrete. Subsidence of concrete after lifting of slump cone is slump value in mm.

For Compressive strength:

Six cube specimens of each percentage (0 and 1%) were casted according to the nominal mix proportion and the size of cube specimen was 150 mm x 150 mm x 150 mm. According to the IS: 10086-1982, cube moulds were used in the experimentation. Specimens were casted in cube mould and filled with concrete in three layers. Hand compaction was applied with tamping rod. Finished the top surface smoothly and de-molded after 24 hrs. Specimens were marked with marker and allowed to dry for some time and immersed in the curing pond. Demoulding of cube specimen was difficult after 24 hrs for specimens casted with admixture of 1% because of extension of setting time. Specimens casted with 1% admixture were demoulded after 48 hrs. The specimens were kept into the curing pond for curing @ temp 27±2° for a period of 28days. After completion of curing period, specimens were removed from curing pond, kept for drying and tested in CTM with 2000 kN Capacity. During the experimentation of casting, it was clearly observed lower ranking of bleeding and segregation.

V. RESULTS

1) Workability of concrete with Sugar and Jaggery:

Concrete has been prepared with addition of two different admixtures (Sugar and Jaggery) with two different percentages as 0 % and 1%. All test results were compared with conventional concrete and results were tabulated in TABLE NO. 2. Based on the experimental results, as the percentage of admixtures increased, consequentlyslump cone factor 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. During the demoulding after 24 hrs, cube specimens were exhibited cracks. So, demoulding of specimens carried out after 48 hrs for 1% of admixture. The basic reason for extending the setting of time is adsorption of sugar and jaggery acted 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 has been improved.

Table no.2: Workability of concrete with Sugar and Jaggery as admixture.

Sr. No	Admixture	% of Admixture	Slump value in mm
1	Normal	0	107
2	Sugar	1	122
3	Jaggery	1	135

2) Compressive strength of concrete with sugar and jaggery as admixtures:

The compressive strength of concrete measured for both admixtures after 7 and 28 days. From TABLE no. 3 & 4, it is clear that, as the percentage of admixture increased, the compressive strength in both cases increased. The only reason for improvement of strength was bonding. Sugar and Jaggery had good bonding property and it was proved that in olden day's jaggery was used as bonding material in construction. Among these two admixtures raw jaggery was best suited admixture into the concrete composition and strength values.

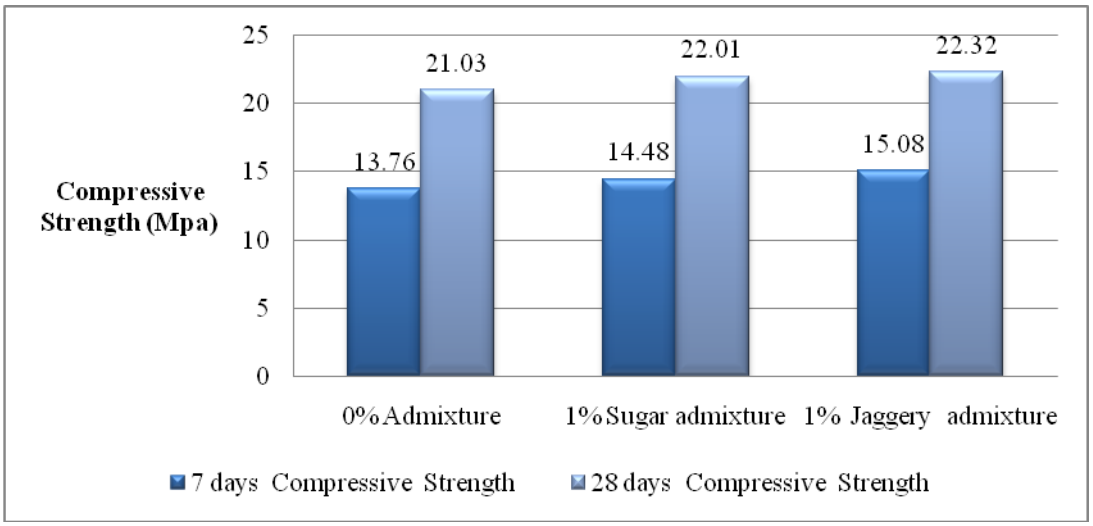
Table no. 3: Compressive strength of concrete with Sugar added as Admixture.

SPECIFICATION	7 DAYS COMP. STRENGTH (MPa)	AVG. (MPa)	28 DAYS COMP. STRENGTH (MPa)	AVG. (MPa)
No Admixture	13.24	13.76	20.31	21.03
	13.77		20.88	
	14.27		21.91	
1 % Sugar Admixture	14.53	14.48	21.77	22.01
	14.08		22.44	
	14.84		21.82	

Table 4: Compressive strength of concrete with Jaggery added as Admixture.

SPECIFICATION	7 DAYS COMP. STRENGTH (MPa)	AVG. (MPa)	28 DAYS COMP. STRENGTH (MPa)	AVG. (MPa)
No Admixture	13.24	13.76	20.31	21.03
	13.77		20.88	
	14.27		21.91	
1 % jaggery Admixture	15.11	15.08	22.62	22.32
	14.93		21.91	
	15.20		22.44	

Graph no. 1 Comparison of Compressive Strength



VI. CONCLUSIONS

- Concrete made by using jaggery as an admixture gives better workability than concrete made by using sugar as an admixture and conventional concrete.

- Concrete made by using jaggery as admixture gives better compressive strength than concrete made by using sugar as an admixture and conventional concrete.

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