

# Impact of sugar on setting time and compression strength of concrete.

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## ABSTRACT

Cement and concrete are the most important engineering materials in the construction industry. Atmospheric conditions play crucial roles on the properties of concrete. Construction activities are accomplished through laid down procedures and parameters such as temperature and humidity. Concreting in hot weather above 100°F accelerates the early hydration of cement and produce concrete with high strength at early ages but later, the strength is reduced considerably.

The use of sugar to delay the setting of cement at the construction site is cheap and readily available. This experiment determines the effects of sugar on the setting time of cement and compressive strength of concrete. The mix adopted for the experimental works was 1: 1.5:3: with W/C ratio of. All the specimens were water cured for 7 and 28 days. The compressive strength specimens were of cube dimension with 15cmx15cmx15cm. Different percentages of sugar admixtures were taken as 1 and 1.2% by weight of cement.

**Keyword :** - : OPC-ordinary Portland cement, sugar, setting time and compression strength, workability

## CHAPTER 1- INTRODUCTION:

### 1.1 Introduction:

Concrete is a mixture of coarse aggregates (CA), fine aggregates (FA), concrete and water in appropriate proportion. In certain situations, concrete 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 types of admixtures.

### 1.2 Problem Statement:

- Cracks formed in Hot weather conditions.
- Increase in the cost of admixtures.
- Cheaper alternative to be found.

- Also, chemical admixture are not found as easily as sugar.

### 1.3 Objectives:

- To study the change in setting time of concrete by using sugar.
- Replacing chemical retarders by natural Sugar.
- To study the effect of sugar on compressive strength of concrete.
- To promote sugar as an optimum retarder.

### 1.4 Scope of project:

- We can get easy and user-friendly retarder.
- In case of transportation of concrete mortar, we can use this instant retarder instead of waiting for the availability of chemical retarder.
- We can improve the compressive strength just by adding sugar instead of addition of chemical admixtures.
- We can replace pollution causing chemical admixtures by environment friendly admixture i.e., sugar.

## CHAPTER 2- METHODOLOGY

### 2.1 Introduction to the methodology:

Cement: Ordinary Portland cement was used.

Fine Aggregates: locally available river sand passing through 4.75 mm IS Sieve was used.

Coarse Aggregates: Crushed stone obtain from local sources has been used.

Water: water was obtained from the tap.

Admixture: Sugar was used in the concrete production. A white crystalline solid easily soluble in water and easily available in market and used in the experimental works. Sugar was added in concrete mix with three different dosages as 1 and 1.2% by weight of concrete.

### 2.2 Experimental Setup

In order to compare the initial setting time, final setting time of concrete and compressive strength of concrete after adding sugar into the concrete, different percentages of sugar admixtures were used such as 1 and 1.2% by weight of concrete. Mixed design adopted for experimental work was 1:1:2.

### 2.3 Procedure

OPC 53 concrete sample was taken to perform the test. Sugar used to perform the experiment; it was dissolved in required amount of water. In order to determine the Consistency and setting time of concrete paste vicat apparatus, conforming to IS: 5513-1976, was used. The test was performed conforming to IS. The standard consistency of a concrete paste was recorded as amount of water added that permits 5 to 7 mm penetration of vicat plunger from the bottom of the vice mould (IS:4031(Part 4)1988). Similarly setting time was measured as per IS:4031(Part 5),1988-initial setting time as the period elapsed between the time of adding water to the concrete to the time when needle fails to pierce the mould by  $5 \pm 0.5$ mm; final setting time as period elapsed between the time of adding water to the concrete to the time when the annular ring fails to make the impression on the mould as the final setting time. Compression test were taken of samples.

#### 1. CUBE CASTING

#### 2. Material Testing

##### 2.1 Finding specific gravity:

Specific gravity: Specific gravity of aggregate is the ratio of the weight of given volume of aggregates to the weight of equal volume of water.

##### 2.2 Collection of a materials:

1. Cement
2. Fine Aggregates
3. Coarse Aggregates
4. Water
5. Sugar

##### 1.3 Testing for initial setting time:

Initial Setting Time: The time elapsed between the moments that the water is added to the cement, to the time that the paste starts losing its plasticity.

- Initial time of setting is the time required by the concrete for its early setting.

- Concrete must be applied to the place of its use before its initial setting. Generally, the initial setting time of OPC is 30 min.

## 2. Cube Casting

- The size of cube mould is 150mm
- For taking sample and fill cube mould



### 2.1 Procedure for Casting of Concrete Cubes:

1. Clean the standard cube moulds 6 Nos thoroughly and tight all nuts-bolts properly.
2. Apply oil to all contact surface of mould.
3. Size of mould is normally from the mixing spot while concreting.
4. Take the random sample from the mixing spot while concreting.
5. Fill the concrete in cubes in 4 layers.
6. Compact each layer with 25 Nos of stroke by tamping rod.
7. Finish the top surface by trowel after completion of last layer.
8. Each specimen should be taken from various locations of proposed concreting.
9. After 24 hours remove specimen out of mould.
10. While removing, take care to avoid breaking of edges.
11. Put coding on cubes by paint or marker, coding should be self-explanatory showing site name, concrete location, building number and date of casting.
12. Submerge the specimen in clean fresh water till the time of testing.
13. Test 3 specimens for 7 days and 3 specimens for 28 days curing.
14. Average strength of 3 cubes represents the strength of concrete of particular portion of the structure.

### 3. Testing for compressive strength

Compressive strength of concrete:

Compressive strength of concrete is the Strength of hardened concrete measured by the compression test. It can be defined as the capacity of concrete to withstand loads before failure.

The compression strength of concrete is a measure of the concrete's ability to resist loads which tend to compress it.

It is measured by crushing cylindrical concrete specimens in compression testing machine.

The compressive strength test is the most important, as it gives an idea about the characteristics of the concrete.

### CHAPTER 3 - RESULTS AND DISCUSSIONS

The concrete paste with different percentages of sugar admixtures were studied for changes in setting time. The concrete cube with different percentages of sugar were examined for variation in slump value and compressive strength of concrete.

Table 1.: Setting time of cement

No. of specimen	% Of sugar by weight of concrete	Initial setting times (minutes)	Final setting time (minutes)
1	0	160	250
2	1	918	6875
3	1.2	1187	7902

Cement paste with different percentages of sugar were examined for initial setting time and final setting time and the results are shown in table. It can be observed that both initial and final setting time were found increasing in percentages of sugar mixed with concrete by weight.

Table 2: Workability of concrete with Sugar as admixture

SR.NO.	ADMIXTURE	% OF ADMIXTURE BY WT. OF CONCRETE	SLUMP VALUE IN mm
1	SUGAR	0	110
2		1	190
3		1.2	200

Table 3: COMPRESSIVE STRENGTH (0% Sugar 7 DAYS)

SR.NO.	WEIGHT gm	LOAD KN	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	AVERAGE COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )
1	8668	420	18.66	18.98
2	8706	435	19.3	
3	8715	428	19.0	

TABLE 4: COMPRESSIVE STRENGTH (0% Sugar 28 DAYS)

SR.NO.	WEIGHT gm	LOAD KN	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	AVERAGE COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )

1	8778	570	25.33	25.72
2	8698	588	26.13	
3	8715	578	25.69	

TABLE 5: COMPRESSIVE STRENGTH (1% Sugar 7 DAYS)

SR.NO.	WEIGHT gm	LOAD KN	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	AVERAGE COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )
1	8618	430	19.11	19.40
2	8625	445	19.78	
3	8665	435	19.33	

TABLE 6: COMPRESSIVE STRENGTH (1% Sugar 28 DAYS)

SR.NO.	WEIGHT gm	LOAD KN	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	AVERAGE COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )
1	8652	590	26.44	26.37
2	8648	585	26	
3	8660	600	26.67	

TABLE: COMPRESSIVE STRENGTH (1.2% Sugar 7 DAYS)

SR.NO.	WEIGHT gm	LOAD KN	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	AVERAGE COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )

1	8510	470	20.89	20.39
2	8617	448	19.91	
3	8653	458	20.36	

TABLE: COMPRESSIVE STRENGTH (1.2 % Sugar 28 DAYS)

SR.NO.	WEIGHT gm	LOAD KN	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	AVERAGE COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )
1	8637	598	26.58	26.56
2	8688	610	27.11	
3	8595	585	26	

#### CHAPTER 4 - CONCLUSION:

- From the above-mentioned results, it is clear that by adding different percentages of sugar there is change in properties of concrete takes place.
- The test carried out at 7 days and 28 days, the comparison is made between the varying proportions 0%, 1% and 1.2% of addition of sugar in concrete mix for setting time, workability and compressive strength.
- From the above-mentioned results, it is clear that by adding different percentages of sugar there is change in properties of concrete takes place.
- The workability increases when the dosage of admixture that is sugar was increased.
- The setting time of concrete increases with increase in percentage of sugar. The compressive strength increases as the dosage of sugar increase at 1.2%.
- So a careful use of sugar can be economical in comparison to commercially available set retarder.

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