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Effect of Sugar on Setting-Time and Strength of Concrete

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ABSTRACT: Cement and concrete are the important materials in the construction field. Atmosphere plays important role on concrete property. Hence admixtures are used to maintain standard condition. The use of sugar to lower setting time of concrete at construction site and it is cheaply available. The mix design used for the experiment was 1:1.22:2.78 with water cement ratio 0.45. All the specimens of dimension of 150x150x150 were provided water curing for 28 days. After the 28 days the max compressive strength for 0.06% of sugar and water cement ratio is 0.36,0.45,0.50 are 48.88 N/mm2, 44.44N/mm2, 40.14 N/mm^2.

KEYWORDS: compressive strength, ordinary Portland cement, setting time

I. INTRODUCTION

Most of the civil engineering works are based on the site work but concreting on hot environment (above 100 f) increases the early hydration of cement and produce concrete of high strength at early age, but the strength on later reduced. Further the rapid evaporation of water is responsible for plastic shrinkage in concrete whereas cooling is responsible for tensile stresses and cracking. So, for maintaining the standard condition, admixtures are used. Retarders are admixtures that increases hydration period by increasing the setting time

The life span, strength and other properties of concrete depend on its ingredients, on the mix design compaction, placing and curing. Concrete blocks have its own property like strength, binding and life

span, but it can't be used in all places due to different climatic conditions in different countries. change in weather condition causes change in initial setting time of concrete. Accelerator and retarder are used decrease and increase the initial setting time of concrete specially in summer and winter sessions. With different types of admixtures used like Retarder- gypsum and sugar etc. and Accelerator- calcium chloride etc

Sugar is a carbohydrate of i.e., a substance composed of oxygen, carbon and hydrogen. It is useful when concrete used in hot weather, when the normal setting time of concrete is lowered by the higher surrounding temperature such as Rajasthan, Gujrat etc very small amount of the order of 0.06 % of sugar can lower initial setting time by 45 minute 45 second. Usually, eight different percentage of sugar admixture was taken as 0.0, 0.02, 0.04, 0.06, 0.08, 0.1, 0.2, 1.0 % by weight of cement.

II .OBJECTIVES

1. Sugar is used as retarder for concrete.
2. It is better to use a commercial mixture admixture with a known property
3. Mixing sugar in concrete prevents the cement from joining with water and lowers the hardening of the mineral.
4. Sometimes to keep concrete moist, sugar-based solutions are used.
5. Sugar helps to lower the setting of cement

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III. MATERIAL AND METHODOLOGY

3.1 Materials

1. cement: Portland cement is hydraulic cement which hardens in water to form a water-resistant compound. the hydration products behave as binder which holds the aggregate together to form concrete.

2. fine aggregates: The size of fine aggregate is below 4.75 mm.

3. coarse aggregates: It should be durable, dense, hard and clean.

4. waters: The water used should be free from impurities and the w/c ratio taken 0.45 in experiment

5. Admixture: sugar is used in concrete mixture. sugar is used in concrete mix in 0.0,0.02,0.04,0.06,0.08,0.1,0.2, and 1.0% by weight of cement.

3.2 Methodology

OPC of 53 grade cement sample is taken to perform the test. Sucrose crystal (C12H22O11) sugar is dissolved in required amount of water to perform the experiment. To determine the setting time of cement vicat apparatus conforming to IS: 5513-1976 is used. The standard consistency of cement paste is recorded as the amount of water added which permits 5 to7 mm penetration of vicat plunger from the bottom of the vice mould (IS:4031 -1998) similarly setting time is measured as per IS:4031 (part 5), 1988 – initial setting time as the period elapsed b/w the time of adding water to the cement to the time when the annular ring fails to make the impression on the mould as the final setting time. The test is conducted at the temperature of 25 to 29 c and the relative humidity within 60-70.

S.N.	Sugar content as % of weight of cement	Initial Setting time (min:sec)	Final setting time (min:sec)
1	0.0	40:00	390:00
2	0.02	47:00	420:00
3	0.04	55:00	450:00
4	0.06	65:45	495:00
5	0.08	42:13	375:00
6	0.1	34:20	230:00
7	0.2	09:15	76:30
8	1.0	02:13	31:20

IV. CASTING OF CUBES

Sugar when used in correct proportion acts as Retarder but when it is used in large amount its opposites its property i.e., it behaves as accelerator. so, it should be used in proper proportion. An amount of 0.06% by weight of cement is found to lower both the setting time and also shows around 15% of increase in compressive strength at 28 days for 0.45 w/c ratio. Sugar above 0.08% by weight of cement increases the setting time with nominal gain in initial strength. Large volume expansion was noted in the sample because cracks were formed in the sample. So we should use sugar carefully.

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V. EXPERIMENTAL TEST RESULTS

Table 2: Average compressive strength of the concrete of the concrete for 0.45 w/c ratio

S.N.	Sugar content as % of weight of cement	Average compressive strength (N/mm2)
1	0.0	29.77
2	0.02	33.19
3	0.04	35.87
4	0.06	44.42

Table 3 : Average compressive strength of the concrete for 0.36 W/C ratio

S.N.	Sugar content as % of weight of cement	Avg compressive strength of the concrete (N/mm2)
1	0.0	34.09
2	0.02	37.01
3	0.04	41.13
4	0.06	48.83

Table 4: average compressive strength of the concrete for 0.50 w/c ratio

S.N.	Sugar content as % of weight of cement	Avg compressive strength of the concrete (N/mm2)
1	0.0	28.50
2	0.02	31.50
3	0.04	32.40
4	0.06	40.10

VI. CONCLUSION

From this experiment we found that when sugar is mixed with concrete the change in properties of concrete take place.

- The setting time of concrete increases with the increase in the percentage of sugar up to 0.06%. Beyond 0.06% use of sugar we found that both initial and final setting times reduces. Sugar when used in less proportion acts as retarder.
- The delay in setting time of concrete at this level of sugar content (0.06%) could be useful in preventing cold joints and in reducing early setting of cement in hot weather concreting.
- Sugar above 0.08% by weight of cement accelerated the setting time with nominal gaining initial strength. Excessive volume expansion was noted in the sample as cracks were formed in the sample itself.

So we should use sugar carefully.

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