



Effect of Sugar on Concrete

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ABSTRACT

Sugar, a product found in almost every home, has a rather interesting effect on concrete. If added to concrete mixtures, sugar has the ability to retard the activity of cement hydration process. This delay in setting time can enable more workability and simple manipulation of the concrete mix a factor that can be useful when say constructing in hot areas as the concrete sets too quick. Studies show that small additions of sugar, below 0.1% of the cement weight, can increase the setting time of concrete without adversely affecting the long-term strength of concrete. Nonetheless, high sugar content has negative impacts that include a considerable reduction in the concrete structure because of the disruption of C-S-H formation, which is essential in concrete strength and hardness. Thus, the effect of sugar on concrete is concentration meaningful with the aid of which one can establish that only a proper dosage of reagents has a constructive effect. The present abstract aims at discussing the potential of sugar as either a performance enhancing or a deteriorating additive in concrete applications, thus pointing out that moderation might be key to improving construction procedures while at the same time avoiding the dangers of overuse. More research is needed to determine the precise concentrations of sugar and the microstructural effects of the sugar on concrete.

KEYWORDS – Admixtures, Retarders, Sugar, Compressive Strength, Setting Time, Workability, Density

LITERATURE REVIEW

This has been identified to be an important area of discussion on the use of sugar as an admixture in concrete, in as much as its effect on the rate of concrete setting, strength determination and concrete durability is concerned. There are papers concerning different types and concentrations of sugars, and their physicochemical impacts on concrete characteristics. Literature review on how sugar affects the hydration process, workability, compressive strength and durability of concrete is presented below.

1.Abalaka, A. E. (2011). The increases in initial and final setting times are apparent up to sugar content of 0.06%. Reduction in setting times begins from 0.08% sugar content and flash setting occurs from 0.2% to 1%. Cement paste samples at increased curing temperature containing 1% sugar has been reported to have very quick hydration (Garci Juenger and Jennings 2002). Cement pastes with sugar content from 0.6% have values of initial setting time below minimum time of 60 minutes requirement prescribed by ENV 197-1 (1992) for cements with strength up to 42.5 MPa.

2.Usman, N. D., Chom, H. A., Salisu, C., Abubakar, H. O., & Gyang, J. B. (2016)

The study concludes that:

1. Sugar delays the setting time of cement by up to 1.33 hours at dosage level of 0.06% by weight of cement.
2. There was no effect on the workability and compaction using sugar as admixture in concrete.
3. Higher compressive strength can be achieved in concrete by the use of sugar as admixture.
4. The optimum dosage level of sugar as a set-retarding admixture is 0.06% by weight of cement.
5. Consequently, sugar perform satisfactorily as a set-retarding admixture in concrete.

3.Azad, M. A., Rahman, S., & Chowdhury, R. (2020, January). 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: 1.24: 2.39 with W/C ratio of 0.56. All the specimens were water cured for 7, 14 and 28 days. The compressive strength specimens were of cylindrical dimension with 200 mm height and 100 mm diameter. Different percentages of sugar admixtures were taken as 0, 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.08, 0.1, 0.2 and 0.3% by weight of cement. Both the initial and final setting time of cement paste were found increasing with the increment of sugar percentages and up to 0.1% sugar the initial setting time was found within limits which were 116 minutes. At all curing period the concrete compressive strength was found maximum

for 0.08% sugar. The increments of concrete compressive strength were 22.4%, 19.6% and 20.3% more than plain concrete with 0% sugar in curing period of 7, 14 and 28 days respectively.

4. Mokanmiyo Adedeji Olawale

The research concluded that the initial and final setting times for 0.06%, 0.08%, 1%, 2% and 3% of sugar by weight of cement for the cement paste samples were obtained as 87 minutes and 467 minutes, 90 minutes and 480 minutes, 120 minutes and 495 minutes, 133 minutes and 510 minutes, 157 minutes and 540 minutes respectively. The compressive strength at 28 days for 0.06%, 0.08%, 1%, 2%, 3% of sugar in concrete was obtained as 26N/mm², 26N/mm², 1N/mm², 0N/mm², 0N/mm² respectively.

5. Khan, B., & Baradan, B. (2002)

The research shows that

- 1) Setting of cement was retarded by incorporation of sugar in cement under all conditions of curing. Consequently, setting-times were extended. The extension in setting-time was increasing with an increase in sugar content up to a certain limit (□0.15%) and then started to drop with further increase in sugar content. Sugar accelerated the cement setting when a higher sugar content (□0.3%) was used
- 2) Relatively low retarding tendency was shown by sugar under the second and third curing conditions.
- 3) 0.15% sugar-content acted as an Optimum Sugar Content for retarding the setting.

6. Kawade, A., Kamthe, I., & Khemalpure, A. B. According to their research the test carried out at 3 days, 7 days, 14 days and 28 days, the comparison is made between the varying proportions 0%, 0.05%, 0.1%, 0.15%, 0.2%, 0.25% of addition of sugars in concrete mix for Setting time, Workability & Compressive strength. Sugar is mixed with concrete and it is observed that the workability and setting time increases with increase in dosage of admixture. Collapse of Slump was observed in both the admixtures at a dosage of 0.1%. The compressive strength increases as the dosage of the sugar increases as compared to ordinary concrete as 0.1% addition of sugar shows maximum results further addition gives the fluctuations in the results and the setting time, workability affects a lot.

7. Suryawanshi, Y. R., BHAT, P. N., Shinde, R. R., Pawar, S. B., & MOTE, N. (2014)

According to their research the amount of sugar powder 0.1% of the total weight of cement gives increased initial and final setting time and improves compressive strength up to 15 -20%. By using sugar in concrete the workability of the mortar also increased. Thus it is beneficial when concrete pumping use for concreting, it is helpful because of its fluidity. The ill effect of time lag on compressive strength of concrete could be reduced by using sugar as a retarding agent.

8. Nikhil, T. R., Kumar, H. N., & Lakshmish, T. P. (2019).

It is observed from studies that addition of Sugar increases workability of concrete in compaction factor test. 0.02% of sugar solution is optimum dosage which increases the compressive strength of concrete. Addition of Sugar increases 6.8%, 9.4%, and 11.88% in compressive strength, Flexural and split tensile strength of HVFA concrete with sugar when compare to HVFA concrete without sugar. Addition of Sugar increases the density of concrete, so Sugar induced concrete can be less permeable concrete. Concrete with Sugar as additive showed more resistance to acid attack.

CONCLUSION

Hence from the study it is evident that addition of sugar as an admixture in concrete is useful, most especially due to its effect with regard to retarding the setting time and increasing workability. Researchers show that at these concentrations, which range from 0.05 percent by weight of cement, sugar hinders the stage of hydration which may be useful where long working time is required or in regions of high temperatures where concrete hardens very fast. It also has the potential of enhancing early age compressive strength for the same reasons at the same controlled level of retardation as seen by more closely packed crystals laid down inside the cement matrix.

However, as it is with any type of blend, including oils, dosage is very important. Sugar in concrete is added over 0.2 percent by weight of the cement then it disadvantages the concrete by slowing down the setting time, and for the loss of long-term strength and durability. This emphasises the requirement of proportions concerning the addition of sugar in the concrete mixtures due to its adverse effects on structural performance.

The preliminary result of the tests on the impact of sweetness of the sugar in the concrete matrix revealed some positive result especially instant on the physical property of concrete but the longer term consequences, durability of the concrete and strength of the sugar admixed concrete requires more research. In future researches targeting the same aspects will be crucial in establishing the viability of using sugar as a hearty and sustainable concrete enhancer in construction purposes.

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