



Comparison of the Effect of Adding Coca-Cola and Sugar on Setting Time and Concrete Compressive Strength

Tamrin Rahman, Annisa Miranda^(✉), Juli Nurdiana, and Mardewi Jamal

Faculty of Engineering, Mulawarman University, Samarinda, Indonesia
annisamrnd254@gmail.com

Abstract. This study aims to compare the effect of the addition of Coca-Cola and granulated sugar on the performance of the mixture. This research is using experimental method. First, watch the effect of granulated sugar and sugar content in Coca-Cola given on the weight of cement at the initial setting time and the final setting time of cement. Then watch the compressive strength of concrete with a variety of samples. The percentage of sugar content in Coca-Cola used varies, namely 0%; 2.5%; 5%; and 15%, while the percentage of variations in the sugar content used is 0%; 0.27%; 0.54%; 1.08% and 1.62% of the cement weight with 3 specimens respectively. The test results showed that the longest setting time was obtained with a mixture of 15% Coca-Cola with an initial setting time of 1662 min and a final setting time of 2511 min, while the maximum compressive strength test results obtained a mixture of Coca-Cola 2.5% of 22.56 Mpa at 28 days and 34.95 MPa at 60 days. The higher the additional percentage, the slower the concrete will eventually become to some extent. In this study, the use of Coca-Cola produces a better value than sugar.

Keywords: Coca-Cola · Concrete · Compressive Strength · Setting Time · Sugar

1 Introduction

Infrastructure development in East Kalimantan continues to increase. This is inseparable from the community's need for increasingly advanced infrastructure facilities, such as the construction of high-rise buildings, dams and other facilities.

One of the most needed materials in infrastructures development is concrete. Almost all structural elements of various structures can be made using concrete. Concrete has a high compressive strength so that it is one of the advantages possessed by concrete. In addition, the concrete mix material is easy to obtain and the concrete is easy to make according to the planned shape, which is an advantage of using concrete.

However, because Kalimantan tends to experience a tropical climate known as warm and humid weather, especially in the city of Samarinda which is prone to flooding, it can affect the distribution of building materials between regions, especially for the distribution of fresh concrete using a mixer truck.

Concrete technology is also developing. Various kinds of experiments and research were carried out in the manufacture of concrete as an effort to improve the quality of concrete. For areas with a tropical climate, it is necessary to reduce the setting time of the concrete so that the workability of the concrete is maintained during casting.

Concrete setting time is the time from adding water to the cement mixture until the mixture reaches a predetermined stiffness level (SNI ASTM C403/C403M: 2012). Setting time is useful for delaying concrete hardening for several hours as needed. Materials that can be used to slow down the duration of setting time of concrete are called retarders. There are various kinds of chemicals used as retarders, such as Plastocrete-R, Sikamen-520 and so on. However, the ingredients commonly used are sugar and soda because these ingredients are easy to get.

In this research, Coca-Cola will be used as an additional ingredients to reduce the setting time of concrete which will be compared with using granulated sugar, because Coca-Cola has a relatively high sugar content so that it can be compared with granulated sugar. However, because the types of additives used are different, what will be compared is the sugar content in Coca-Cola against granulated sugar.

From this background, an innovation can be made on the concrete mixture to determine the effect of Coca-Cola and granulated sugar as added ingredients to reduce the setting time of concrete, to determine the compressive strength of concrete with added ingredients of Coca-Cola and sugar, and to find out the right composition for the manufacture of concrete with additional ingredients of Coca-Cola and granulated sugar with good quality.

2 Methods

2.1 Research Location

This research was carried out at the Civil Engineering Laboratory, Faculty of Engineering, Mulawarman University (Fig. 1).

2.2 Research Procedures

The research implementation includes the following activities:

1. Study of literature
2. Preparation of materials (coarse aggregate, fine aggregate, Portland cement type I, water, Coca-Cola, granulated sugar).
3. Laboratory examination (sieve analysis of fine and coarse aggregate, moisture content, aggregate silt content, specific gravity and aggregate absorption, and aggregate wear).
4. Mix design.
5. Test object manufacture (normal concrete, concrete with the addition of Coca-Cola 2,5%, 5%, 10%, and 15%, concrete with added sugar 0,27%, 0,54%, 1,08% and 1,62% for the 28 and 60 days tests, each consisting of 3 cylindrical test objects).
6. Setting time test.
7. Compressive strength test of concrete.

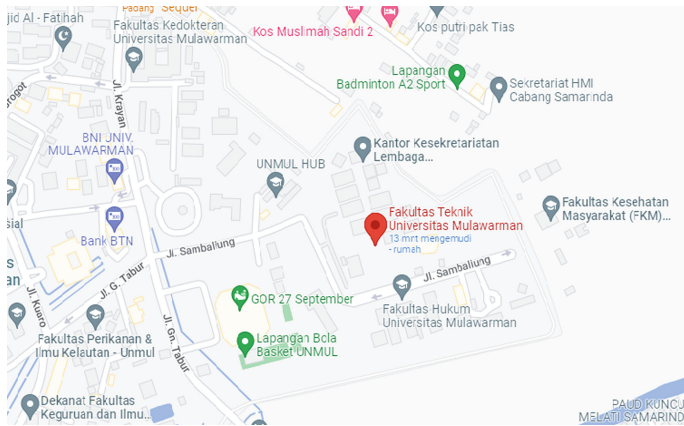


Fig.1. Research location in Faculty of Engineering, Mulawarman University, Samarinda, East Kalimantan.

3 Result and Discussion

The test results in this research are divided into two, setting time and concrete compressive strength. The setting time test aims to find out how long the initial setting time and final setting time are using the vicat test tool. While the compressive strength test aims to determine the magnitude of the load per unit area, which causes the concrete test object break when loaded with a certain compressive force, which is produced by the press machine.

3.1 Results and Discussion-1

Setting time testing using the vicat tool. The initial setting time is when the vicat needle has decreased by 25 mm, while the final setting time is when the vicat needle shows 0 mm or there is no longer decrease. The result above show that the addition of sugar is proven to slow the hardening time of concrete to a certain variation and if it exceeds the maximum variation, the setting time will decrease. While for the variation of Coca-Cola, the more Coca-Cola given, the longer it takes to set. In this research, the longest setting time for the sugar variation was at 0.27% with an initial setting time of 317 min and a final setting time of 582 min. While the longest setting time for the Coca-Cola variation was at 15% with an initial setting time of 1662 min and a final setting time of 2511 min (Table 1).

3.2 Results and Discussion-2

Based on the chart presented, the compressive strength test was carried out at 28 days and 60 days. At 28 days, the compressive strength of concrete with sugar variations did not exceed normal concrete at 21,17 Mpa but concrete with 2.5% of Coca-Cola produced 22,56 Mpa, higher than normal concrete. At 60 days, concrete with 0,27% and 0,54% of sugar produced 29,63 Mpa and 21,62 Mpa, while concrete with 2.5% and 5% of

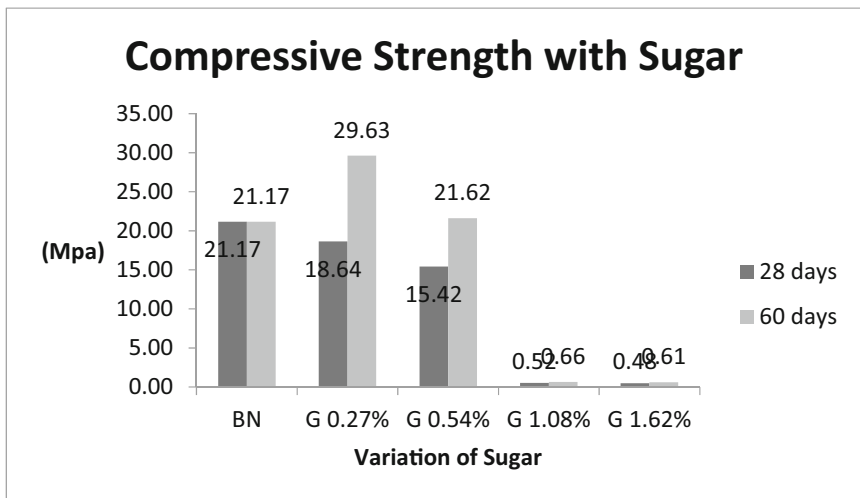
Table 1. Setting time with the addition of sugar and Coca-Cola (following SNI 03-6827-2002)

No.	Variation	Initial Setting Time (Minutes)	Final Setting Time (Minutes)
1	Normal	105	140
2	Sugar 0.27%	317	582
3	Sugar 0.54%	245	463
4	Sugar 1.08%	208	427
5	Sugar 1.62%	183	322
6	Coca-Cola 2.5%	132	207
7	Coca-Cola 5%	182	306
8	Coca-Cola 10%	689	1482
9	Coca-Cola 15%	1662	2511

Coca-Cola produced 34,95 Mpa and 23,69 Mpa. The four variations exceed the result of normal concrete compressive strength. However, concrete with variation 1,08% and 1,62% of sugar, 10% and 15% of Coca-Cola produced poor compressive strength, not even up to 1 Mpa (Figs. 2 and 3).

The addition of sugar or Coca-Cola can slow down the hardening of the concrete and can increase the compressive strength up to a certain percentage. If add too much sugar or Coca-Cola, it will make the concrete brittle and unusable.

In this research, the addition of Coca-Cola produced the longest setting time and the highest compressive strength compared to the addition of sugar.

**Fig. 2.** Compressive strength chart with added sugar.

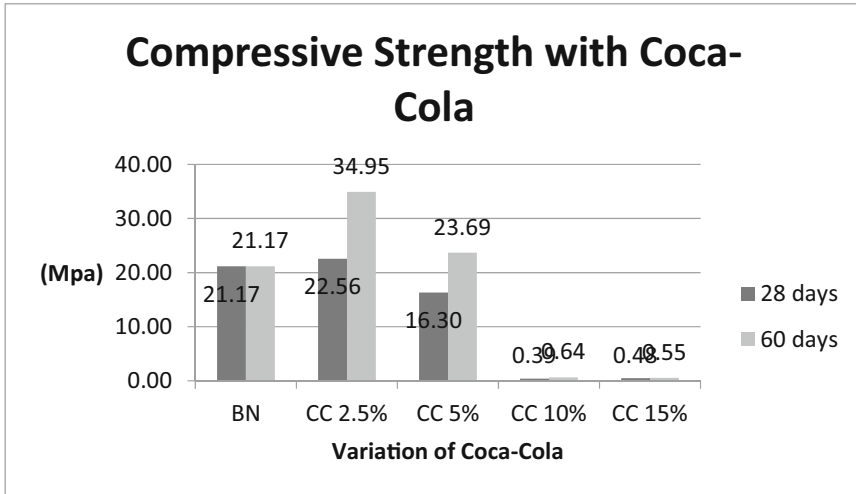


Fig. 3. Compressive strength chart with added Coca-Cola.

4 Conclusion

The addition of sugar and Coca-Cola has been proven to slow down the hardening of concrete and also can increase the compressive strength to a certain percentage, but if given too much Coca-Cola and sugar, it will make the concrete brittle and unusable. In this research, Coca-Cola with variation 2.5% achieved the highest compressive strength of 22,56 Mpa at 28 days and 34,95 Mpa at 60 days. The right composition in order to get a good quality concrete with added Coca-Cola is up to 5% of the cement weight, while for sugar it is up to 0.54% of the cement weight.

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