Study on Admixture of Super Retarding Concrete

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Abstract. This paper mainly studies the influence of five kinds of retarding materials, such as sodium gluconate, sugar, citric acid, maltodextrin and sodium tripolyphosphate, on the setting time of concrete. Through gradient experiment of five different retarders, the influence of the amount of five kinds of retarders on the setting time and strength of concrete is obtained. The experimental results show that different kinds of retarders have different effects on the setting time and compressive strength of concrete. The use methods of super retarded concrete admixtures in 30 hours, 40 hours, 50 hours and 60 hours are obtained by orthogonal experiment.

1. Introduction

The setting time of concrete is an important indicator of concrete workability, directly affects the operational time of concrete, the arrangement of the construction process and construction period, also affects the other indicators of workability and performance after concrete hardening properties and hardening. In order to ensure success in some large-scale projects and large-scale single structures, the initial setting time of concrete must be greatly extended, due to the large volume of concrete, the pouring time is longer, especially in summer. [1] Ordinary commercial concrete retarders cannot be used in places where concrete setting needs to be continued for a long time, due to the short retardation time. In order to extend the setting time of concrete, it is necessary to test the combination and dosage of retarders on the basis of ordinary retarders, so that the setting time of concrete can be controlled and the later strength can be guaranteed. [2][6]

The early setting time of super retarding concrete is longer, on the other hand, the concrete and late must have enough strength to meet the design requirements. This is the super retarding the development of concrete the difficulty. [3] The setting time of concrete depends on the choice and amount of raw materials, including the type and strength of cement, the amount of fly ash, the particle size distribution of aggregates, the type and amount of admixtures, and the performance and performance of other admixtures. [4][5]

This experiment chooses the five common retarder sugar, glucose, sodium, citric acid, sodium tripolyphosphate, maltodextrin, different retarder on setting time and compressive strength of concrete, to the production and application of super retarding concrete admixture to provide the reference.

2. Test

2.1 The raw material

(1) Cement: meng electricity P.O 42.5 cement, its chemical composition and basic properties are shown in table 1.
(2) Sand fineness modulus of 0.8, the silt content is 5%; Mechanism of sand: fineness modulus of 2.8, silt content is 2%; Particle size gravel: 5.0-20.0 mm;
(3) Poly carboxylic acid high performance water reducing agent: in line with the national standard GB 8076-2008, self-control.
(4) Retarder: sugar, glucose, sodium, citric acid, sodium tripolyphosphate, maltodextrin, are industrial grade, in order to facilitate the writing of the article, in turn, use code A, B, C, D and E.

2.2 Test method
This test in the setting time of concrete according to the standard GB/T 50080-2016 the common concrete mixture performance test method standards and determination of the compressive strength of concrete, according to the standard GB/T 50081-2002 "standard of ordinary concrete mechanics performance test method" the provisions to determine test.

3. Results and Discussion

3.1 Concrete mix proportion
Experimental results and analysis this experiment is carried out on the basis of the ordinary C30 concrete test, through the method of adding retarder into the water reducing admixture, the admixture dosage is controlled at 6.5 kg, and the reference mix proportion is shown in Table 2 below.

| mix proportion (kg/m³) | cement | fine sand | Manufactured sand | 5-10 gravel | 10-20 gravel | water | admixture |
|------------------------|--------|-----------|-------------------|-------------|--------------|-------|-----------|
| C30                    | 360    | 250       | 620               | 200         | 800          | 165   | 6.5       |

3.2 Monomer dosage of retarder and analysis of experimental results

3.2.1 Monomer dosage of retarder on setting time of impact
The author studies the five different monomer dosage adding retarder by gradient, the concrete setting time change trend, the result is shown in figure 1 below.

As can be seen from the figure 1, with the increase of dosage of retarder, five kinds of retarder corresponds to the setting time of concrete are present a growth trend. Sugar that is in retarding effect
is the most prominent, the dosage of 10% in 52.5 h, and has showed a trend of growth. Retarding effect of sodium gluconate after sugar, when the dosage of 10% reach 45 h, but has also been showed a trend of growth. Citric acid, sodium tripolyphosphate and maltodextrin retarding effect is more general, setting time trends along with the growth of the admixture is also slower.

3.2.2. Monomer dosage of retarder on the influence of concrete strength
Experiments with different monomer retarder on the strength of concrete under different dosage of data, its content and strength of relationships are shown in figure 2, 3 below.

Fig. 2. The monomer dosage of retarder and the relationship of the strength of concrete for 7 days

Fig. 3. The monomer dosage of retarder and the relationship between concrete strength of 28 days

As you can see from figure 2 and figure 3, under the low content of 0-4%, in addition to sodium gluconate other four retarder corresponding strength of concrete have been a certain degree of adverse effects. Through two figure summarizes can draw, white sugar, glucose acid sodium and sodium tripolyphosphate in 7 days and 28 days strength corresponding concrete reached the maximum value when the dosage of 6%; Citric acid in the corresponding concrete strength as content increased continuously improve; And maltodextrin add played a bad influence on the strength of concrete, only under the dosage of 8% and 10% to improve concrete strength of 28 days, so in the subsequent distribution experiment also abandoned add formula with maltodextrin.
3.3 Compound with retarder test results and analysis

3.3.1 Retarder distribution formula
The author passed the test of the compound with retarder, respectively got 30 h, 40 h, 50 h and 60 h condensation period of retarder compound recipe, formulas are shown in table 3 below for details.

| number | 1       | 2       | 3       |
|--------|---------|---------|---------|
| 30h    | 4%A+3%B | 4%C+4%D | 5%C+3%D |
| 40h    | 5%A+6%B | 6%A+5%C | 6%A+4%D |
| 50h    | 8%A+3%B | 6%A+3%C+3%D | 5%A+10%B |
| 60h    | 10%A+3%B | 7%A+7%B | 8%A+3%C+3%D |

3.3.2 Distribution of retarder's influence on the strength of concrete
Experiments for different composite retarder formula correspond to the strength of concrete data, the formula with different strength relations are shown in figure 4, and 5 below (figure 4, 5, 0 series corresponding without retarder is the strength of the data, the intensity of benchmark data).

![Fig. 4. Distribution of retarder and the relationship of the strength of concrete for 7 days](image1.png)

![Fig. 5. Distribution of retarder and concrete strength of 28 days](image2.png)

It can be concluded from Figure 4 that the 7-day strength of concrete corresponding to different retarder formulations in different setting time periods has no regular change compared with the 7-day strength of the benchmark concrete, and all of them are in a small fluctuation range. The results show
that the composite formula in different time periods has no adverse effect on the 7-day strength of concrete. It can be seen from Figure 5 that the 28 day strength of concrete corresponding to different retarder formulations in different setting time periods is 1-2mpa higher than that of the reference concrete at 28 days.

4. The conclusion

(1) According to the above test results and analysis, the amount of retarder has a great influence on the strength of concrete, and the amount of retarder needs to be strictly controlled to avoid affecting the quality of the project.

(2) Sugar and sugar are monomer acid sodium retarding performance of retarder, the dosage of sodium gluconate in 0-10% range are to enhance the strength of the concrete, and the dosage of sugar in only 6% of concrete under 7 days and 28 days strength ascension.

(3) Through the test, the author has obtained five compounded retarder formulas with retarding time of 30h, 40h, 50h and 60h respectively, and the corresponding concrete strength at 7d and 28d has no adverse effect, and the composite retarder formula obtained in the experiment can improve the 28 day strength of concrete by 1-2mpa, which also proves the compounded retarder formula obtained by the experiment Reliability.

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