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Analysis of Retarder in Mortar

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Abstract: This research wasestablished with the aim of finding out the effect of additional material retarder on cement in waterresistantmortar.This research wasexperimental researchwhich was conducted in the Material Testing Laboratory of the Civil Engineering EducationDepartment in the Engineering Faculty of Universitas Negeri Makassar.In this experiment the cement bundle wastreated with 0% , 0.1% , 0.4% and 0.5% of retarder.The result of this experiment showed that (1) the bundling time increased if the dosage of retader was increased and (2) retarder addition with 0.4% dosage of cement weight can increase the value of water-resistance of the mortar.

Keywords: Retarder, mortar, and compressive strenght.

Intriduction

One of the building materials that is widely used in building construction especially in the work of plastering is mortar. Mortar is made of cement, sand, and water stirred in certain compositions. The cement acts as a binder of sand grains after having sufficient water for the hydration process. The process of binding of cement may be influenced by various factors, such as adding chemicals to change the nature of the mortar.

In plaster work, construction workers make mortar with the ratio of 1 part of cement and 2 parts of sand, or 1 part of cementand 3 parts of sand or 1 part of cement and 4 parts of sand. A mixture of 1 part of cement and 2 parts of sand is usually known as an impermeable mortar that is used to prevent seepage of water in plaster and to avoid moisture that can cause damage to plastering.

Often the building work required impermeable mortar for the security of the building structure to prevent the entry of water through mortar pores that can harm the structure (Khatulistiani, 2008) [1].Some things that can cause cracks in wall plastering,include the amount of water that is too muchin the mixture of mortar, or the temperature is too high, causing the level of water loss in mortar to be greater,resulting in the amount of cement that is too muchin the mortar mixture.

Based on the above description, one of the factors causing cracks in wall plastering is the temperature of the hot air that can accelerate the mortar hardening resulting in a decrease in strengthof the mortar. Therefore, in order to slow the binding time of the plaster a retarder is added that is likely to affect the mortar compressive strength.The retarder is an added chemical substance used to slow the cement hydration process. The retarder is expected to eliminate the cracks produced on the mortar surface due to the rapid hardening process, so that the impermeable nature of mortar can be achieved.

Wangsadinata, (2011) [2] explains that mortar is a mixture of fine aggregates (sand), cement and water and will harden in a certain time. Variations of the mixed portion will affect the quality of mortar produced, especially the compressive strength.Mortar is also used as a binder in brick wall mounting arrangement.

In BSN 2012 (SK SNI 15-2049-2004,) [3] mortar is defined as a material used for building construction consisting of a mixture of cement and fine aggregates. Tjokrodimuljo (1996) [4] explains that: "mortar cement is a mixture of cement, sand and water in appropriate proportions". The ratio of the weight of cement and sand ranges from 1 part of cement and 2 parts of sand to 1 part of cement and 6 parts of sand or more depending on its use.

Lilis (2016) [5] explains that: "mortar is a material that binds coarse aggregates resulting in a solid and strong concrete". The mortar based material consists of cement, fine aggregate, and water. Khatulistiani (2008) [1] explains, "mortar is a material used for building work, made from a mixture of Portland cement (PC).Based on the above,it can be concluded that mortar is a mixture of cement, sand, and water with a certain ratio used in the work of wall plastering, installation of brick walls, mounting tiles / ceramics, and others.

Tjokrodimulyo (1996) [4], states that Portland cement is hydride cement produced by smoothing clinker mainly involving hydrolysis of calciumBased on BSN 2012 (SNI No.15-2049-2004)[3], the cement characteristics consists of: 1) Specific weight, 2) Consistency, 3) Bind time, 4) Subtlety, 5) Eternity, and 6) Strong press.

Istimawan (1999) [6] defines fine aggregates as being generally composed of sand or particles that can pass through a 4-5 mm sieve. In general fine aggregate is called sand, either in the form of natural sand obtained directly from the river or dug from soil.Wangsadinata, 2011 (PBI 1971) [2], explains that water for the

manufacture and treatment of mortar should not contain oil, acid, alkali, salt, organic materials or other materials that can damage the concrete.

Retarder is an added material that serves to inhibit the binding time of concrete. Its use is to delay the binding of concrete (e.g., time conditions) including hot weather conditions or extended hardening time to avoid cold joints. The hydration acceleration process means that the cement uses a certain amount of water for the hydration that was originally used to provide workability properties. Therefore, more water is required at the desired level, which means the compressive strength of the concrete is reduced. High temperatures, low humidity and wind lead to rapid evaporation of water in a mixture during summer. This concrete drying causes cracking on the surface.Retarders delay the cement binding process by forming a thin layer of cement particles thereby slowing the reaction with water. Another way is by increasing the distance between molecules in silicates and aluminates with water molecules by forming temporary compounds. With silicate formation and aluminate hydration, the retarder effect is reduced and the hydration process returns to normal.

The compressive strength of the mortar is defined as the voltage occurring in the specimen on the loading until the specimen is destroyed. Measurement of mortar compressive strength was based on BSN 1990 (SK SNI M 14-1989 F) [7] and Aloysius 1989 (SNI 03-1974-1990) [8]. Loads that are continuously distributed or distributed through the center of gravity are then calculated by the formula:

$$fc' = \frac{P}{A}$$

Where:
fc'= Strong mortar pressure (kg / cm^2)
P = Load (kg)
A = Area of cross section (cm^2)

As for the condition of the value of compressive strength mortar based ASTM C-90 about the value of the minimum compressive strength that must be owned on M type mortar types of mortar used for brick walls, the wall near the ground, the minimum compressive strength value is 86 Kg / cm^2.According to Soetjipto (1978) [9], the quality of mortar compressive strength was influenced by several factors, among others: 1). influence of Portland cement quality, 2). influence of grain arrangement, 3) water effect to make mortar, and 4). influence of temperature.

Research Methods

This researchwas experimental research conducted in the Laboratory of Materialsin the Department of Civil Engineering Education, Faculty of Engineering of Universitas Negeri Makassar.The experimental time of binding of cement was without retarder, and using 0,1%, 0,4% and 0,5% of retarder.Each treatmentwas made with 5 sample specimens. The testing of the mortar compressive strength ~~is~~was done by making mortar assay with the weight ratio of 1 part of cement and 2 parts of sand with four treatment types, without retarder, and 0,1%, 0,4% and 0,5% of retarder.Each treatment was made with 5 samples of mortar. Data analysis using descriptive analysis is presented in the form of tables and graphs.

Results and Discussion

Testing Cement Binding Time

After the cement mixes with water it will bind, then hardens. The length of binding depends on the composition of the compound in the cement and the surrounding air temperature. The binding time of cement paste is the binding time and the final setting time. The initial bonding time is the time required since the cement is mixed with water to become plastic, while the final binding time is the time required since the cement is mixed with water from the plastic to harden. What is meant by hard is its rigid form, but the cement paste should not be burdened, either by its own weight or external load. The initial binding time according to the minimum SII standard is 45 minutes, while the final fastener time is 360 minutes. The initial bonding time is achieved when the inclusion of the vicat needle into the sample within 30 seconds is 25 mm deep. The final binding time is reached when the vertical needle is placed over the sample for 30 seconds, on the surface of the sample.Then after the test the data of the initial and final binding time on mortars that are not given retarder or given a retarder with a certain dose are obtained. The following diagrams show the differences in the duration of the initial and final binding time in each sample group of test specimens.

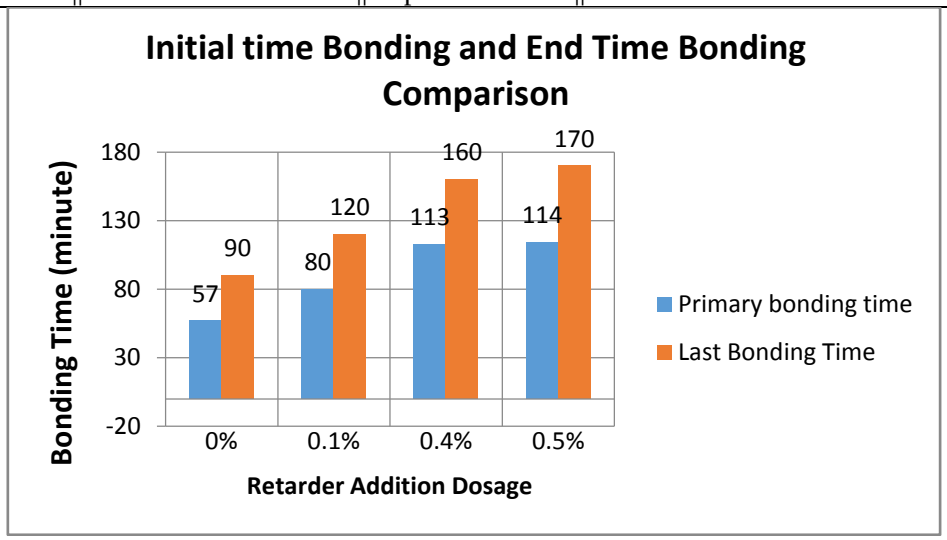

Figure 1. Diagram of comparison of baseline and end time of cement paste

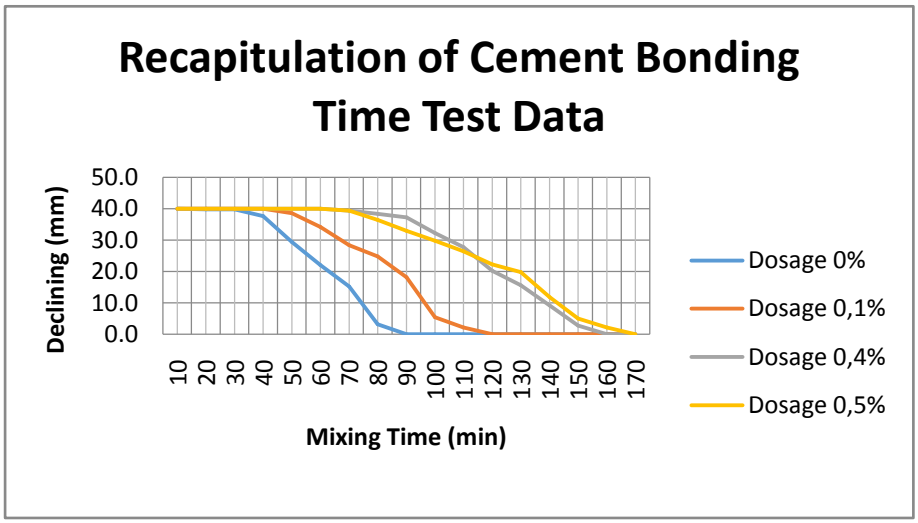

Figure 2. Diagram of the result of testing the time of binding of cement paste

Figures 1 and 2 above show that in the preliminary cement time test on a paste treatment of retarder of 0.1%, a baseline time of 23 minutes was compared to a cement paste not given a retarder. Then on the treatment of cement paste as much as 0.4% of retarder experienced the initial binding time of 33 minutes when compared to 0.1% of cement paste The the cement paste retarder of 0.5% was decreased although not significantly by 1 min compared to the paste retarder of 0.4%.

The final binding time that occurred on the cement paste ~~given retarder~~ also experienced a hardening slowing with a time difference of hardening of 30 minutes compared with cement paste that was not mixed with the retarder. Then on the cement paste,the retarder was decreased to 0.4% when the hardening time ~~for~~was 40 minutes compared to the paste with 0.1% of retarder. Then on the cement paste with retarder of 0.5%, it was the longest time taken compared to the other cement paste with the duration of hardening for 170 minutes or 10 minutes with the cement paste with the retarder of 0.4%.

From the above analysis it can be concluded for each group of test data of cement paste, that the more dosage of retarder given, the longer the binding time of both the initial binding time and the time of the final binding.

Strong Mortar Press Testing

Mortar not given retarder serves as a material of control of the compressive strength of the average mortar with the compressive strength of mortar with the retarder. The test result data show that the compressive

strength value on mortar given by 0.4% of retarder has higher compressive strength than mortar which is not mixed with retarder. The increase in mortar compressive strength can be seen as described in Figure 3 below.

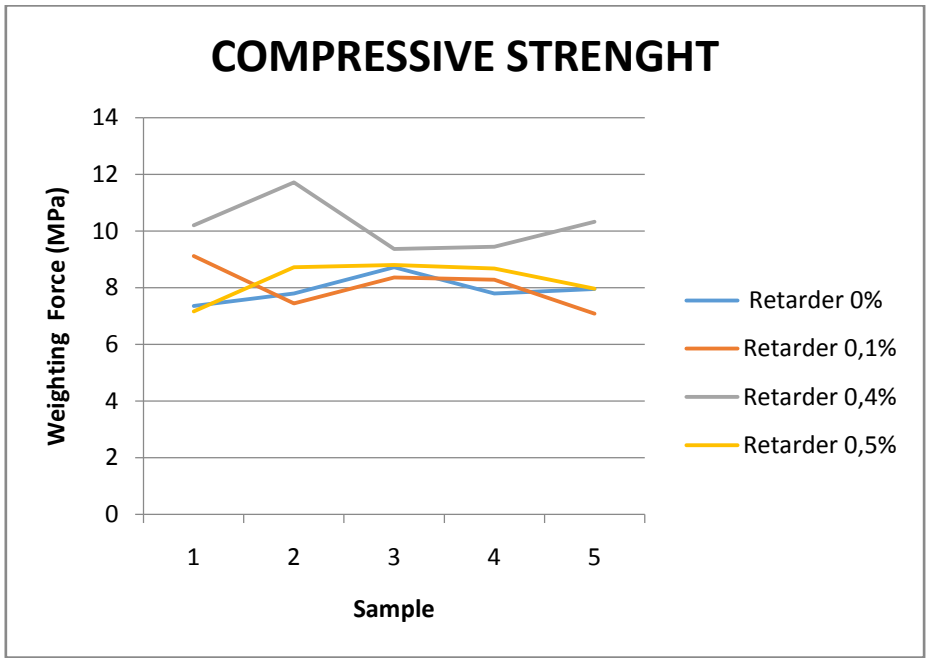

Figure 3. Diagram of test results of mortar compressive strength

Based on the compressive strength test data obtained on the test, the average compressive strength of mortar that was notmixed with retarder was 7.928 MPa while in the mortar with the retarder with the dose of 0.1% the average strength of the press was 8,056 MPa. Based on the ASTM C-90 mortar compressive standard, the minimum value of compressive strength that must be possessed by mortar used in trasram wall also called M type mortar is 8.6 MPa. Mortar mixed with retarder with a dose of 0.4% if mortars that fall in the M category or can be used for temporary transparent wall pairs for mortars with 0%, 0.1% and 0.5% of retarder in the mortar type category S or can only be used on plain wall pairs. However, because the manufacture of mortar made in hot weather conditions, there is a decrease in the value of compressive strength of the mortar. This decrease in the value of compressive strength is due to excessive cement hydration due to overheating temperatures causing cracks in the mortar so that the cement cannot tie the aggregate grains to the maximum.

Therefore, the added ingredients are used to slow the occurrence of cement hydration i.e.,addition of retarder so that the standardized compressive strength value on the mortar can be achieved.Then mortar with added retarder with a dose of 0.4% obtains an average compressive strength of 10.208 MPa which means that standardized compressive strength has been achieved that is above 8.6.MPa. Then on mortar with a dose of 0.5% of retarder, there is a decrease in compressive strength value with an average compressive strength of 8.264% that is below the standard value of compressive strength mortar required for type M that is equal to 8.6 MPa.

From the above description, there is a difference in the yield of mortar compressive strength made in hot weather conditions given with retarder or with no retarder. The following is presented in Figure 4. comparing test results of compressive strength of mortar.

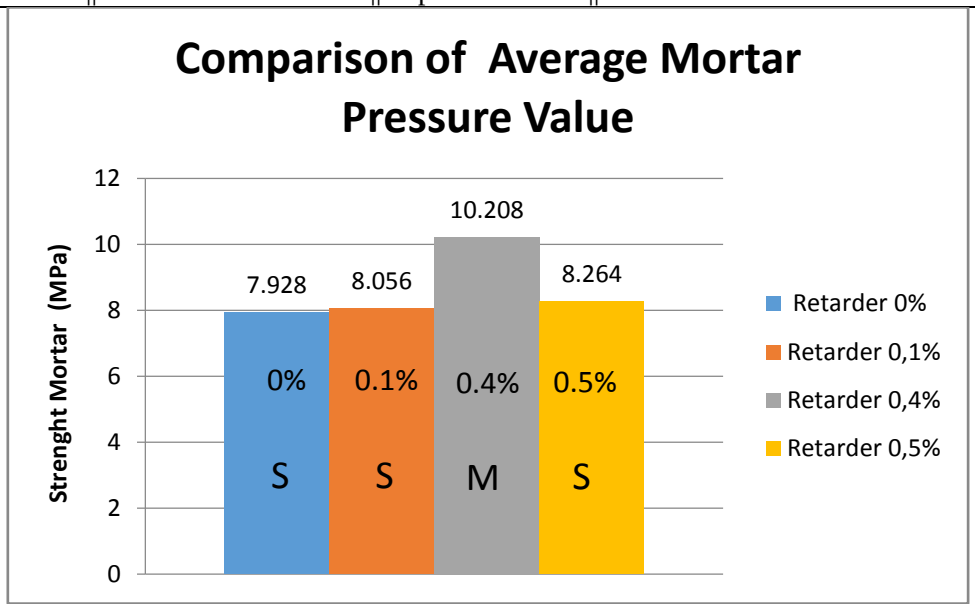

Figure 4. Comparison of average mortar pressure value

Figure 4 shows that mortar with 0.4% retarder is mortar which has the largest compressive strength value compared to other mortar that is equal to 10,208 MPa.From the above analysis it can be concluded that giving a retarder on mortar with a dose of 0.4% of the weight of cement can increase the standardized compressive strength value of the mortar to 8.6 MPa.

Conclusion

Based on the results of the research, it can be concluded that:

1. The more dosage of the retarder given to the cement, the more time it will take to slow down the binding time,~~is~~ either the initial binding time or the time of the final binding.
2. Provision of materials plus retarder with a dose of 0.4% in the mortar mix can increase the value of the compressive strength of impermeable mortar.

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