Effect of heat stimulation to admixture on fresh property of mortar

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1. INTRODUCTION

Superplasticizer (here in after "SP") is being produced in products to improve fresh properties of concrete. In the previous studies, when the mixing temperature is less than 10℃, change effect of SP(Polycarboxylic acid-based) on the fresh properties of concrete. In many cases, the fresh properties of concrete is low reproducibility within mixing 15 minutes [1),2),3)]. But no studies of heating the admixture is for changes in fresh properties of performance.

In this research two types of superplasticizers used, type one is used for precast concrete industries so it has less slump retention polymer(here in after "SP1 "), but type two contains slump retention polymer(here in after "SP2 ").This research aimed to study the impacts of heat stimulation on two different types of SP. The results shows, by the retention polymer type heat stimulation, the flow has been greatly improved as compared to the less retention polymer type .Therefore, fresh properties are greatly improved by applying heat stimulation, it is possible to reduce the admixture amount required on construction, directly affects the environmental aspects of the concrete productions.

2. OUTLINE

This study is intended to carry out investigation on the effects of heat stimulation of admixtures on cement mortar flow by changing the heating conditions. The following cases were focused on the study: Case1. Influence of different heating temperatures on the fluidity effect of heat stimulation of the admixtures. Case2. Influence of heating time of heat stimulation of the admixtures on fluidity of mortar.

2.1 Materials used, mix proportions and heating condition for SP

The materials used for this study are shown in Table 1. The water-cement ratio of mortar was 30%, and sand cement ratio 2.0. The SP heating condition are shown in Table 2. The dosage of SP are arranged to obtaining the targeted flow (approximately 120mm flow at 0 tamp and 200mm at 15 tamp).The admixtures were heated in three different temperatures, 40℃, 50℃ and 60℃(Tolerance of temperatures was controlled as± 1℃).The keeping time of admixtures in the mentioned temperatures were 0.5 hours and 24 hours.

2.2 Mortar mixing method

The Whole procedure was performed in accordance with JIS R 5201"Physical testing methods for cement" Heated admixture were mixed with mixing water after taking out from a constant temperature chamber. The same procedure was applied in non-heating admixture. The ambient temperature of mixing was 20± 3 ℃.

Table 1. Material Used

Materials		Propeties
Cement	N	Ordinary portland cement, density:3.16g/cm^3, specific surface area 3340 c m^2/ g
Fine aggregate	S	Crushed sand from Kanagawa density*:2.63g/cm^3
Admixture	SP1	Superplasticizer (Polycarboxylic acid-based ether)
	SP2	High-performance waterreducing agent(type of AE):(Polycarboxylic acid-based ether)
* : in saturated surface-dry condition		

Table 2. Admixture heating condition

Heating condition	Heating temp. (˚C)	Heating time (hr)
Case 1	40,50,60	0.5
Case 2	60	0.5,24

3. RESLUTS

3.1 Impact of heating temperatures on the fluidity

Influence of temperature differences in flow rate of SP is shown in Fig1. Admixture heating condition is shown in Fig 2. In the case of 0 tamp in SP1, the flow rate tends to improve with increasing stimulations temperatures in all experimented temperature degrees, 40℃, 50 ℃ and 60 ℃. Where in the case of 15 tamps, SP1 shows heat temperature degrees, 50 ℃ is almost the same as the 60 ℃.

The fluidity of mortar by using heat stimulated SP2 is greater than the heat stimulated SP1 in both 0 and 15 tamps measurements. In this research, it is believed that heat stimulation technique activate the slump retention polymer, available in SP2 at early time and cause remarkable flow in SP2.

Keywords: heat stimulation, superplasticizer, workability, high range water reducer, fresh properties.
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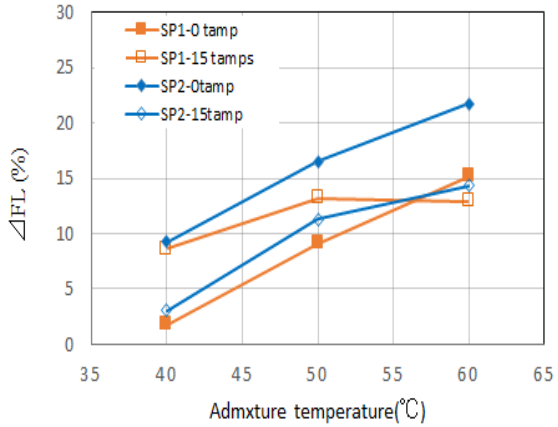

Fig.1 Influence of temperature in flow rate of SP.

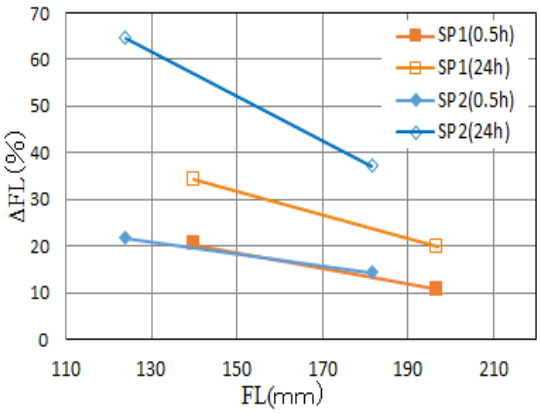

Fig.2. Effect of heating time in flow rate of SP.

3.2 Effect of heating time on the fluidity

The influence of heat stimulation of the admixtures on the fluidity of mortar was considered by changing the heating time.
Effect of heating time on increasing of flow rate of SP1 and SP2 are shown in Fig 2. In the figures, the 24 hours heating time of (SP1 and SP2) are compered to their 30min heating time, the figure shows an improvement of more than 10% in their all fluidity properties. SP2 (RMC type) of 0tamp is compared to the SP1 (PCa type) of 0tamp, there are increase more than 30% by heat effect of 24hours.

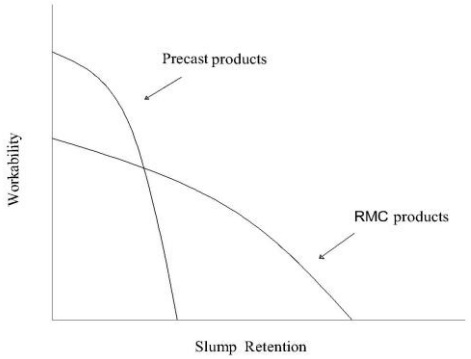

Fig.3. The schematic of performance of the two used products.

4. DISCUSSION

The schematic of performance of the two used products are shown in Fig 3. In this study, for better distinguishing of the heat stimulation effects, This is due to effect of different type of SP products used in this studies, It carried out investigation which could be categorized in two categories, precast type product (Here in after “PCa type”) and ready-mix concrete RMC products (called a retention polymer type). RMC type is compared to PCa type, dispersing effect of the cement is exerted on the late for adapt on-site[4], it is believed that it is activated by heat stimulation. Therefore, we will continue to research by focusing on the future slump of retention polymer.

5. CONCLUSIONS

By applying heat stimulation technique to the SP, the fluidity of mortar improved in comparison to non-heated SP. The effect of fluidity of mortar the heat stimulate SP varies with heating time. Longer heating time, increases the tendency of liquidity compared non-stimulated ones. Applying the heat stimulated SP2 (RMC type) of 0tamp is compared to the SP1 (PCa type) of 0tamp, there are increase more than 30% by heat effect of 24hours. RMC type shows higher fluidity compared to with type of the SP1 (PCa type). The SP2 shows better heat stimulation effect with anytime, it is believed that slump retention polymer in this SP may activated by heat stimulation. Hence, by applying heat stimulation technique, it is possible to reduce the admixture amount required on construction. This technique is directly affects the environmental aspects of the concrete productions.

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