

A Fundamental Study on the Effect of Pigment Use Amount on the Color of Colored Mortar

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ABSTRACT

Focusing on the mortar portion, which is considered to determine the color of concrete, experimental verification was conducted on the effect of the amount of pigment used on the color of colored mortar. In the preliminary experiment, the color of the mixed powder of cement and pigment constituting the cement paste appearing on the surface layer of the mortar was measured. As a result, it was found that the region in which the color of the mixed powder effectively changes as the pigment substitution rate increases or decreases is in the range where the pigment substitution rate relative to the cement mass is lower than 5% to 10%. Further, in the range where the pigment substitution rate relative to the cement mass is lower than 5%, a clear change appears in the $L^*a^*b^*$ values of the mortar as the pigment use amount is increased or decreased. As the pigment substitution rate increased, the L^* value decreased and the a^*b^* value approached the pigment color. However, since mortar with the low pigment substitution rate of 1.25% can be clearly confirmed visually to be blue, green, or yellow, relatively inexpensive colored mortar is considered to be usable, taking into account the optimum use method, including the factor of cost.

1. INTRODUCTION

Colored concrete colored with pigments is used for building exterior walls and floor slabs. The amount of pigment added to such concrete is often based on the standard addition amount specified by the pigment manufacturer. However, a wide variety of materials and blends are used for concrete, and the dosage of pigment is adjusted as required. When determining the dosage of pigment, factors such as the water-cement ratio of concrete and color change over time must be taken into account, but there are very few research reports on such systematic experiments. In the present study, focusing on the mortar portion, which is considered to determine the color of concrete, experimental verification was conducted on the effect of the amount of pigment used on the color of colored mortar.

2. Preliminary experiment with mixed powder

Prior to the main experiment, a preliminary verification experiment was conducted regarding the color of the mixed powder of cement and pigment constituting the cement paste that appears on the surface layer of the mortar. Photo 1 shows a picture of the experiment. In the

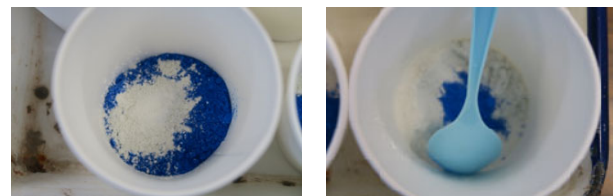


Photo 1 Experiment on the effect of pigment substitution rate on cement color

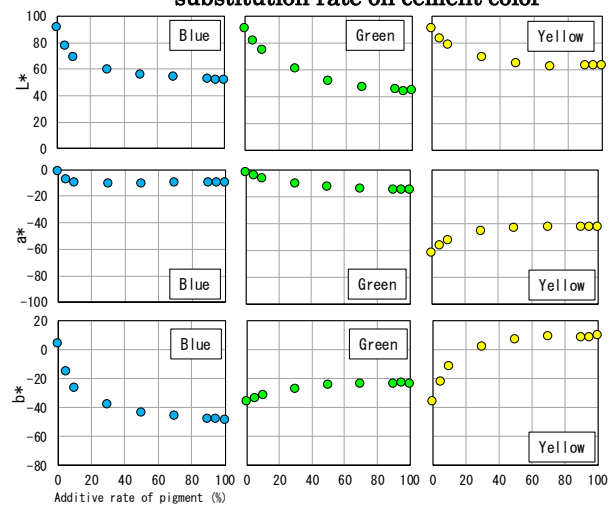


Fig. 1 Relationship between pigment substitution rate and $L^*a^*b^*$ values of mixed powder



Photo 2 Color Measurement of Colored mortar

experiment, powders in which blue, green, or yellow pigment was mixed with white portland cement at a substitution rate of 0% to 100% were manufactured, and the L*a*b* values of the mixed powders were measured. The experiment's results are shown in Fig. 1. Similarly, to past findings in other fields, the influence of the pigment substitution rate on the color of the basic powder (cement) becomes milder as the pigment substitution rate increases. Looking solely at the L*a*b* values of the mixed powders, the region in which the color of the mixed powder effectively changes as the pigment substitution rate increases or decreases was considered to be in the range where the pigment substitution rate relative to the cement mass is lower than 5% to 10%.

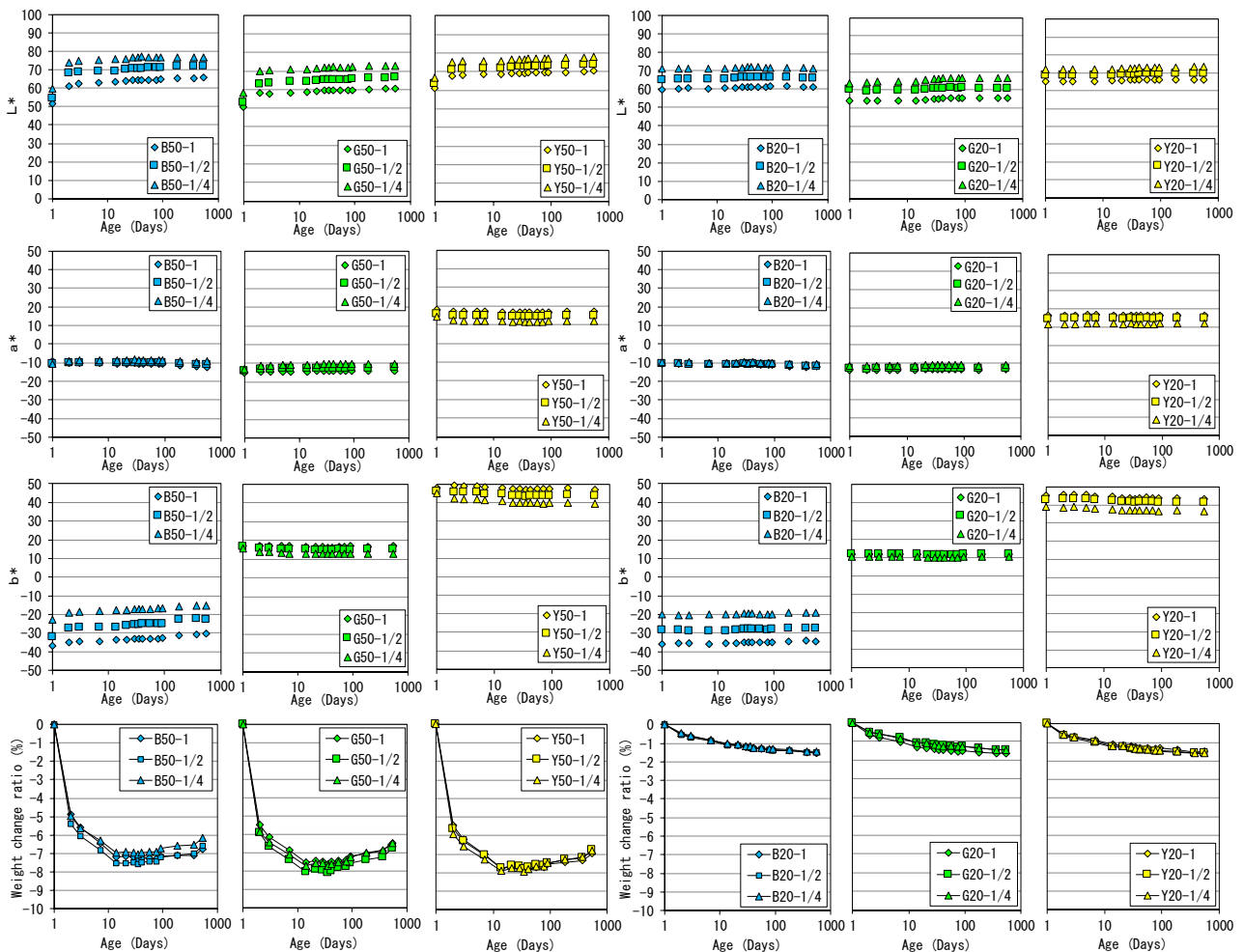
3. Mortar experiment

The color measurement results are shown in Fig. 2. Further, in the range where the pigment substitution rate relative to the cement mass is not over than 5%, a clear

change appeared in the L*a*b* values of the mortar as the pigment dosage was increased or decreased. As the pigment substitution rate increased, the L value decreased and the a*b* value approached the pigment color. Moreover, although color change over time occurred in the mortars with the water-cement ratio of 50%, the differences in Lab values due to the different substitution rates were not narrowed.

4. CONCLUSIONS

- 1) The region in which the color of the mixed powder effectively changes as the pigment substitution rate increases or decreases was considered to be in the range where the pigment substitution rate relative to the cement mass is lower than 5% to 10%.
- 2) In the range where the pigment substitution rate relative to the cement mass is not over than 5%, a clear change appeared in the L*a*b* values of the mortar as the pigment dosage was increased or decreased.



(Blue specimen) (Green specimen) (Yellow specimen) (Blue specimen) (Green specimen) (Yellow specimen)
 W/B=0.5 W/B=0.2

Fig.2 Measurement results of L*a*b* value and weight change ratio