Protein Fabric Dyeing with Indigo and Japanese Pagoda tree for Color Mixture

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1. INTRODUCTION

As an eco-friendly material, natural dyestuff has merits of nature conservation, value adding of dressing, appliances of natural resource, and so on.

Thus, research on natural dyeing materials has recently increased in order to decrease harm due to dyeing wastewater and water pollution which come out of synthetic dyeing material. In addition to the merits, natural dyeing material can achieve different color effects from synthetic material's effects. But, we may have more difficulty storing and extracting natural materials than synthetic ones. Among many difficulties for industrialization of natural dyeing material, various color realization and its reproducibility have been the most important concern.

Thus, in this research, mixture dyeing of Indigo's blue color and Japanese pagoda tree's yellow color was applied to cotton and linen which are natural cellulose fiber, and to rayon which was reproduced cellulose fiber. After that, color changes of natural material in those cellulose textile were checked for color diversificational possibility. Mixture dyeing of Indigo and Japanese pagoda tree's colors to wool and silk was done to find color diversificational and representational possibility of green color, which is the intermediate color of Indigo's blue and Japanese pagoda tree's yellow.

2. EXPERIMENT

Specimens

Silk, which was purchased in Sombe, was used for this research after scouring, and wool, which was also purchased in Sombe, was used without scouring. Scoring of silk was processed with 5% (o.w.f) power soap and 8%(o.w.f) Na_2CO_3 in the conditions of bath ratio 1:50, treated temperature 95 ~100℃ and 1 hour scouring treatment.

Dyeing material

To achieve specifically quantified dyeing conditions and color reproduction, Japanese pagoda tree's extracted powder was purchased from Mikwang International Co. Ltd. and Indigo powder was purchased in Sombe.

Dyeing of fabrics

Color mixture dyeing was fulfilled in two ways: (i)post-dyeing with Japanese pagoda tree with Indigo, and (ii) vice versa. In Indigo dyeing, Indigo's color covers the pre-dyed color in color mixture dyeing if concentration becomes higher. So, to avoid this situation, concentration was diluted. In addition, to check the possibility of color diversification to exhibit intermediate color of the two materials, mixture dyeing was done. Finally, repeated mixture dyeing was also fulfilled to obtain an appropriate number of dyeing and concentration.

Dyeing ability measurement

By using Computer Color Matching System(Spectra Flash 600 Plus, Data Color Co. USA), dye uptake (henceforth, K/S) was calculated by standard reflectance obtained from a 400nm wavelength. And By using Computer color matching system (Color Quest XE. Hunter lab. USA), color difference (henceforth, ΔE) and H(V/C) were measured in the colorimetric data L*, a*, b* .

3. ERESULT AND DISCUSSION

Dyeability of wool and silk in Japanese pagoda tree dyeing solution according to concentration

Dyeing ability of wool and silk in Japanese pagoda tree dyeing solution according to concentration.

Because K/S values vary on the concentration of dyeing material, dye uptake was higher as K/S values increased. For wool and silk, the higher the concentration of Japanese pagoda tree extract solution becomes, the more the amount of uptake becomes. The increasing amount of wool fabric's dye uptake is a little higher than that of silk's.

Dye ability of wool and silk in repeated dyeing with Indigo dyeing solution

Fig. 2 shows changes of dye uptake when wood and silk were dyed repeatedly until 7 times with Indigo dyeing solution under the conditions of bath ratio 1:50 and treated temperature 10 minutes at

room temperature. From the results of Fig. 1, we figured out that, although K/S value of wool increased according to dyeing repeated times, the degree of K/S value increase became less after three times of repeated dyeing than before three times. For silk fabric, the K/S values increased a little before 5 repeated times, but decreased after 5 times. When we checked dye uptake according to repeated dyeing, wool fabric showed higher dye uptake than silk fabric. It was thought that, even though wool and silk fabrics all have amide and amino groups, wool has relatively more dye uptake site than silk due to its fine structure.

Dyeabilility of mixture dyed fabrics in the treatment order of Indigo post-dyeing after concentration-leveled Japanese pagoda tree

To mix up Indigo and Japanese pagoda tree colors, two ways were tried in the following orders: (i) post-dyeing with Indigo after Japanese pagoda tree, and (ii) vice versa. When the repeated time of Indigo were constant, dye uptake of both wool and silk increased as the concentration of Japanese pagoda tree's solution was raised. On the other hand, dye uptake showed different results depending on which fabric was dyed according to the number of the repeated times of Indigo dyeing when the concentration levels of Japanese pagoda tree's solution was constant. Therefore, we observed that K/S value of silk reached the highest in the conditions of concentration of Japanese pagoda tree 25%(o.w.f), and one time dyeing with Indigo. That is, the higher concentration level of Japanese pagoda tree solution was raised and the less the repeated times of Indigo dyeing was, the higher K/S values were achieved. Considering dye uptake of each fabric, wool showed higher than silk.

Dyeability of mixture dyed fabrics with Japanese pagoda tree of leveled concentration after repeated pre-dyeing with Indigo

When the concentration of Japanese pagoda tree was constant, dye uptake of wool increased as the number of Indigo dyeing times was raised. On the other hand, dye uptake of silk showed trivial differences as Indigo dyeing was repeated. Especially, wool fabric showed big increase in dye uptake compared with the case of Indigo post-dyeing after Japanese pagoda tree pre-dyeing. Compared with wool, silk showed lower dye uptake, because silk has lower amount of functional group that can do ion-bond.

4. CONCLUSION

To achieve mixture dyeing we used Indigo's blue color and Japanese pagoda tree's yellow color. After making stock solution in a certain degree, we made 4 different concentration levels for Indigo , and 5 levels for Japanese pagoda tree. By using these stock solutions, we dyed wool and silk fabrics and checked the dyeing ability. The results were as followed:

1. Dye uptake of sample fabrics dyed with Japanese pagoda tree's dyeing solutions according to concentration levels was higher for wool than for silk. Dye uptake of sample fabrics repeatedly dyed with Indigo was also higher for wool than for silk.
2. In color mixture dyeing dye uptake of each dyeing fabric appeared higher for wool than for silk. Although dye uptake of each fabric appeared higher for wool than for silk, the dye uptake of Japanese pagoda tree dyeing solution after Indigo dyeing treatment overall appeared higher than that of Indigo dyeing after Japanese pagoda tree solution dyeing treatment. Especially for wool fabric, the ordered dyeing of Japanese pagoda tree after Indigo showed far more dye uptake than the ordered dyeing of Indigo after Japanese pagoda tree.
3. In the mixture dyeing with Indigo and Japanese pagoda tree, the range of diverse color distribution increased in the case of Japanese pagoda tree's pre-treated dyeing after Indigo, when compared with the order of Indigo after Japanese pagoda tree. I concluded that, in color mixture dyeing, earlier dyeing with Japanese pagoda tree solution was more effective for color diversification, but for wool and silk fabric, earlier dyeing with Indigo was more effective for intermediate color shade exhibition.

5. REFERENCES

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