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Dyeability with Temperature of Indigo Printing Gel

Sang-Phil Lee and Jeong-Rak Choi
Dongshin University

Ⅰ. Introduction

We used Indigo for the test. Indigo is an annual grass in knotgrass family, and its scientific name is *Polygonum tinctoria* H. gross. There are several types of Indigo: *Indigofera tinctoria*, *Polygonum tinctoria*, and *Strobilanthes flaccidifolius* D.C. *Polygonum tinctoria* is originally from India and is cultivated in China, Korea, and Japan. Indigo has indican (glucoside organic compound)' in its leaf. Indican is hydrolyzed to be indoxyl, and becomes insoluble Indigo by being fermented. Indoxyl is reduced to be yellow soluble leuko, which is adsorb to fabric and oxidized to be blue Indigo. Traditionally, it is believed that it has been handed down in Honam and Yongnam Area. There are only two persons left as recognized as intangible cultural assets. Because soluble extracts are extracted with pigments in the extraction process, natural dye can provide natural and deep color, which is not possible with chemical dye. Nowadays, most fabrics are dyed using *Chimyum* (submerged dyeing), and traditional *Chibortbangyum* (tie dyeing) and *Batickbangyum*(batic dyeing) are used only for art-work or small-work.

The objective of the study was to develop printing method by making Indigo in gel condition. We used powdered extract from Indigo and raw silk fabric for color fastness testing according to KS K 0905 regulation. We gelled indigo extract by varying C.M.C. and hydrosulfide ($Na_2S_2O_4$). We tested the temperature effect on dyeing by changing temperature from 30 to 80℃ (30, 40, 50, 60, 70, and 80℃).

Ⅱ. Materials and Methods

1 Materials

Raw silk fabric was used for testing color fastness as defined in KS K 0905. The characteristics of test fabric are shown in 〈Table 1〉.

〈Table 1〉. Specificity of Fabric

Fabric	Weave structure	Yarn Number		Fabric counts(thread/5cm)		Weight (g/m)
		Warp	Weft	Warp	Weft	
Cotton	Plain	21S (20tex)	36S (16tex)	141〈	135〈	100±5

2. Dye

Powdering Indigo Dye: blue Indigo dye was extracted by oxidation process, filtered (G5 glass filter), and freeze-dried (Ilshinlab, Korea).

3. Dying

1) Dyed on testing fabric to be washed and dried. A color-measuring instrument (JX-777, Color Techno System Corporation, Japan) was used to measure Hunter's Value, color difference (△E), and Mussel's HV/C of the dyed fabric.

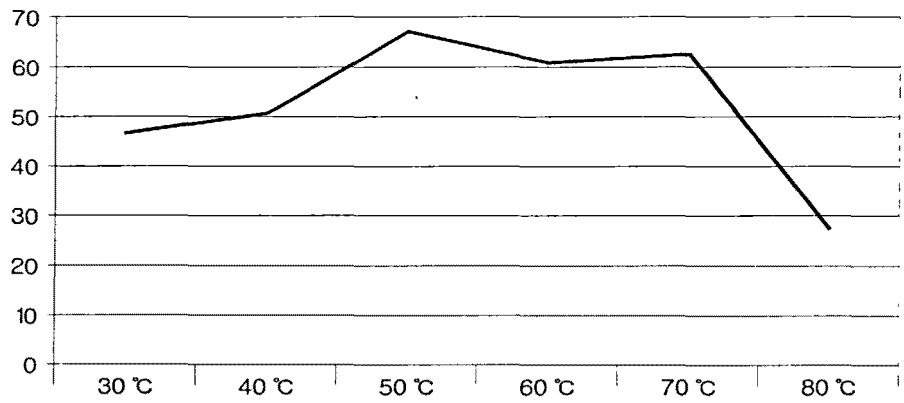
2) We tested the effect of dye concentration in 1:50 ratio. We printed on fabric at room temperature andoxidized 5~10 minutes to wash and dry. Dye concentration was 50%, and we added C.M.C. 50% and hydrosulfide 150%.

3) We evaluated the effect of temperature on dyeing. Dying was performed at 30, 40, 50, 60, 70, and 80℃.

Ⅲ. Results and Discussion

〈Table 2〉 Color Position of Indigo Printing Gel by the Temperature

Temperature	L	a	b	ΔE	ΔL	Δa	Δb	H	V	C
RefrenceValue	95.27	-0.22	1.46					0.00	9.43	0.00
30℃	53.19	-4.32	-18.31	46.68	-42.09	-4.11	-19.76	1.48PB	5.16	4.78
40℃	49.31	-4.37	-19.45	50.66	-45.96	-4.16	-20.91	1.41PB	4.78	4.97
50℃	33.46	-3.16	-24.59	67.14	-61.82	-2.95	-26.04	1.65PB	3.26	5.69
60℃	40.34	-3.88	-24.40	60.83	-54.91	-3.66	-25.86	1.66PB	3.92	5.96
70℃	38.79	-3.04	-25.30	62.56	-56.48	-2.83	-26.76	2.00PB	3.77	6.08
80℃	72.26	-4.79	-12.86	27.48	-23.01	-4.57	-14.31	0.93PB	7.07	3.71



〈Fig 1〉 Color difference(△E) of Indigo Gel by the Temperature.

Ⅳ. Conclusion

We tried to develop a method to print after gelling Indigo. We used the extracts from Indigo and raw silk fabric for testing color fastness as defined in KS K 0905. Varied amount of C.M.C. and hydrosulfide was used to gel Indigo powder. Dying was performed at 30, 40, 50, 60, 70, and 80℃ to evaluate the effect of temperature on dyeing. △E were 37.73, 41.85, 63.04, 60.07, 61.86, 31.23 at 30, 40, 50, 60, 70, and 80℃, respectively. Generally, △E increased as temperature increased. However, there was little difference in △E between 50, 60, and 70℃ conditions, and 80℃ reduced △E abruptly. The results suggested that 50~70℃ is most appropriate for gel printing of Indigo dye.

The results indicated that optimum temperature is 50~70℃ for printing Indigo. We found the possibility of diversifying patterns using natural dye through printing. The results will allow us developing a new technique for pattern fabric, which can be used for daily clothes.

Reference

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