

A Study on the Discrimination of *Angelica* Species Roots by Dyeing

Youngnam Seo*

Dispensary of Oriental Medicine of Kumkangdang, Yeosu 550-816, Korea

Abstract - This study was performed to investigate the discrimination of *Angelica gigas*, *Angelica acutiloba* and *Angelica sinensis* on the treatment of chromaticity and colorfastness. *Angelica gigantis* root has been used as a Korean traditional medicine for the treatment of woman disease. Natural dyes give us many great benefits, including diversified color, but no pollution. These studies were carried out acetate iron, dichloride copper and alum with a mordant to ramie fabric. The ramie fabric was dyed with *Angelica gigas*, *Angelica acutiloba* and *Angelica sinensis*. The results of experiment showed as follows: In discrimination by dyeing, the colors of *Angelica acutiloba* and *Angelica sinensis* were very similar, but that of *Angelica gigas* was different. There were no differences among colors of materials using non-mordant. But dyeing with iron acetate and copper dichloride were showed dark in *Angelica gigas* than other *Angelica* species.

Key words - *Angelica gigantis* roots, Chromophoric, Colorfastness, Discoloration.

Introduction

In the long history of man, dyeing has been used as a means to represent the grace of god and inner esthetic consciousness of man.

The root of *Angelica gigas* has been used for the treatment of physical weakness, joint pain, abdominal pain and constipation. *Angelica gigantis* was gathered at the late autumn and dried. The whole plant tastes pungent, sweet and bitter (Euk, 1981). It grows naturally in humid mountain district over northeast Asia such as Korea, Japan and China (Lee, 1982). *Angelica gigantis* root's main compounds are decursin, decursinol, nodakenin, α -pinene, limonene, β -eudesmol, elemol bergapten, hydrophthalid, valerophenone (Euk, 1981). Especially the root of Korea *Angelica gigas* contains decursin that used as a indicating pyranocoumarine substance.

In discrimination by morphology, the color of flower of *Angelica acutiloba* and *Angelica sinensis* were white and that of *Angelica gigas* was red. Shapes of leaves of *Angelica acutiloba*, *Angelica sinensis* and *Angelica gigas* were different each other. The colors of cutting section of root of *Angelica acutiloba* and *Angelica sinensis* were brown, but that of *Angelica gigas* was dark (or deep) brown.

This study was carried out to discriminate of three *Angelica* species. *Angelica acutiloba*, *Angelica gigas* and *Angelica sinensis* by dyeing method.

Materials and Methods

Angelica acutiloba, *Angelica gigas* and *Angelica sinensis* were used for searching dyeing plant. Testing material was ramie fabric. And acetate iron, dichloride copper, alum were used for mordant.

Testing progress was as follows: The dried samples (1.2kg) were washed, soaked and boiled in 12L of water to get I solution. Again, previously used samples were boiled with 8L and 4L of water for the second and third to get II and III solution. All the solutions were mixed and staining solution for the test were prepared.

The ramie-fabric was tampered for 10~20 min treat in 40~60°C in dyeing solution. The ramie-fabric was soaked with dyeing solution during 30 min, it was to prevent ramie-fabric from stain. It was repeated for 2-3 times. The ramie-fabric was washed 5 to 6 times after dyed.

The ramie fabric was treated with mordant as acetate iron, dichloride copper and alum 20~30 min. After treating with mordant ramie-fabric was washed many times. The weights of each mordants were 2~3 percent in ramie-fabric weight.

Results and Discussion

Colorimetry

This investigation was performed to find out ramie-fabric mordant with *Angelica acutiloba*, *Angelica gigas* and *Angelica sinensis*. Color chart of Japan Inc-chemical company was used in

*Corresponding author. E-mail : sy1687@hanmail.net

Table 1. Color differences of the roots of species by mordants

Cultivars	Mordants	Temperature (°C)	Testing time (min)	Color effect
A. acutiloba	non-mordant	40~50	20~30	ivory
	alum	40~50	20~30	yellow
	iron acetate	40~50	20~30	light-gray
	copper dichloride	40~50	20~30	light-blue
A. gigas	non-mordant	40~50	20~30	light ivory
	alum	40~50	20~30	ivory yellow
	iron acetate	40~50	20~30	light-gray
	copper dichloride	40~50	20~30	green yellow
A. sinensis	non-mordant	40~50	20~30	ivory
	alum	40~50	20~30	yellow
	iron acetate	40~50	20~30	light-gray
	copper dichloride	40~50	20~30	light-green

Table 2. Color chart of the root of *Angelica* species by mordanting with alum, iron acetate and copper dichloride

Cultivars	Color sample	Mordants	Color chart
A. acutiloba	Japan Inc-chemical company	non-mordant	Chart 3(Y20%)
		alum	Chart 3(Y20%)
		iron acetate	Chart 3(C20%+M20%+Y30%)
		copper dichloride	Chart 3(Y20%)
	Doosung Paper (Designers color 139)	non-mordant	O61
		alum	Y6
		iron acetate	Y5
		copper dichloride	N7
A. gigas	Japan Inc-chemical company	non-mordant	Chart 4(Y30%)
		alum	Chart 5(M10%+Y40%)
		iron acetate	Chart 11(C10%+M10%+Y20%+BL10%)
		copper dichloride	Chart 5(C10%+M10%+Y40%)
	Doosung Paper (Designers color 139)	non-mordant	L57
		alum	Y13
		iron acetate	N4
		copper dichloride	G58
A. sinensis	Japan Inc-chemical company	non-mordant	Chart 4(Y10%)
		alum	Chart 3(C10%+M20%+Y40%)
		iron acetate	Chart 3(C10%+M10%+Y20%)
		copper dichloride	Chart 5(C10%+M10%+Y40%)
	Doosung Paper (Designers color 139)	non-mordant	L59
		alum	Y13
		iron acetate	Y5
		copper dichloride	G58

1) Japan Inc-chemical company' color chart: C=Blue, M=Red, Y=Yellow, BL=Black

2) Doosung Paper' color chart: G=Gray, D=Dark color, N=Natural, L=Light, P=Pale, O=Fade

this test. The colorimetry was shown in Table 1 and Table 2.

Testing temperature was 40°C for 30 min. The test was carried out at for *Angelica acutiloba* showed ivory in non-mordant, yellow in alum, light-gray in iron acetate and light-blue in copper dichloride. *Angelica gigas* showed light ivory, ivory yellow, light-gray and green yellow. *Angelica sinensis* showed ivory, yellow, light-gray and light-green.

In Japan Inc-chemical company's color sample, *Angelica acutiloba* showed chart 3, *Angelica gigas* showed chart 4, 5 and 11, *Angelica sinensis* showed chart 3, 4 and 5. In Doosung Paper's color sample, *Angelica acutiloba* showed O61, Y6, Y5 and N7. *Angelica gigas* showed L57, Y13, N4 and G58. *Angelica sinensis* showed L59, Y13, Y5 and G58.

In discrimination by dyeing, the colors of *Angelica acutiloba* and *Angelica sinensis* were very similar, but that of *Angelica gigas* was different. There were no differences among colors of materials using non-mordant. But dyeing with iron acetate and copper dichloride were showed particularly, especially dark in *Angelica gigas* than other *Angelica species*.

Measure the colorfastness

Colorfastness of ramie-fabric dyed with mordants was shown in Table 3, Table 4, and Table 5.

Investigation of light colorfastness was carried out with four kind of ramie-fabric and three *Angelica* species. It was basked in the light for 20 hrs. Discoloration had 8 grade in the case of no-mordant and dichloride copper's grade was 4-5, alum's grade was 2 and acetate-iron's grade was 3-4. Discoloration of alum and acetate-iron was higher grade than non-mordant and dichloride copper.

Investigation of washing colorfastness was carried out with 4 kind of ramie-fabric. It was tested by KS K0430 A-1. Discoloration of alum and dichloride copper was higher than non-mordant and acetate iron. Pollution was not significant in this test.

Investigation of abrasion colourfastness was carried out with 4 kind of ramie-fabric. The ramie-fabric was rubbed ten times at the rate of 900g weight per 10 seconds. Abrasion colourfastness has 5 grades. Pollution was not significant in this test.

Angelica acutiloba and *Angelica sinensis* were no significant in this test, but *Angelica gigas* showed higher grade in colorfastness.

Table 3. Colorfastness to light of fabric

Mordants	Discoloration (grade) ¹⁾			
	Non-mordant	Alum	Acetate-Iron	Dichloride copper
A. acutiloba	4-5	2	3-4	4-5
A. gigas	5	3	4-4	4
A. sinensis	4-5	2-3	3-4	4

¹⁾ levels of discoloration

Table 4. Colorfastness to washing of fabric

Mordants	Non-mordant		Alum		Acetate-Iron		Dichloride copper	
	Discoloration	Pollution	Discoloration	Pollution	Discoloration	Pollution	Discoloration	Pollution
A. acutiloba	2-3	4-5	1	4-5	2-3	4-5	1	4-5
A. gigas	2	3-4	1-2	4	2-3	4-5	1-2	4
A. sinensis	2-3	4	1-2	4-5	2-3	4-5	1	4-5

*grade: levels of discoloration and pollution

Table 5. Colorfastness to abrasion of fabrics

Mordants	Pollution(grade)			
	Non-mordant	Alum	Acetate-Iron	Dichloride copper
A. acutiloba	5	5	4-5	4-5
A. gigas	4-5	4-5	4-5	3-4
A. sinensis	5	5	4-5	4-5

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