

The Effects of Extractive Conditions on the Dyeing Properties of Black Walnut hull

Hojung Kim, Munyoung Park, Soyeong Bae, Chacheol Park*, Gang Sun**

Dept. of Fashion Design & Merchandising, Kyungsoo University, Busan, Korea

*Footwear Industry Management Graduate, Dongseo University, Busan, Korea

**Division of Textiles and Clothing, University of California, Davis, USA

1. INTRODUCTION

Black Walnut(*Juglan nigra*) is an important kind of Walnut trees that is cultivated around the world for food and timber. Because of the rich nutrition, nut kernels are consumed as a valuable food. Even the shells are utilized as a filler in plastics and a glue extender with the grounded form. But the hull part is less useless compared with nut kernel, it is known the ancients had been used the green hull as a colorant though. Because it is mainly composed with tannins that are polyphenols of vegetable origin and the proximity of hydroxyl groups on the aromatic rings. Natural tannins are most complex and non-uniform, specifically degradable by heat, alkaline or acid. And another component, Juglone(5-hydroxy-1,4-naphthalenedrone), yellow-brown crystals which stain the skin, occurs chiefly as its colorless reduction product in all green and growing parts of walnut trees and the unripe hulls of the nut. This study is examined, if we try make efficient use the walnut hull as a colorant, the effects of extractive conditions on the properties of walnut hull extracts and the dyeing properties.

2. EXPERIMENTAL

Material and Extraction: Walnut hull that was removed from the nuts crushed into the powder. Aqueous extracts of walnut hull were prepared by adding 1-4g of hull powder to 100ml distilled water varying extractive conditions.

Dyeing and color measurement: 10g/l of walnut hull was extracted as a stock solution at 40°C and 100°C for 90min. Dyeing was carried with diluted solution to two times at a bath ratio of 100: 1(o.w.f), 30-120min., 40-100°C.

K/S values for apparent dye uptake, CIE L* a* b* data and Munsell H, V/C values were evaluated using spectrophotometer.

Characterization : The absorbance spectra of extracts with various extractive conditions were measured using UV-Vis. Spectrophotometer(Shimadzu,Japan). FT-IR spectra by KBR meathod (FT-IR Spectrometer,Nicolet Impact 400D,Japan) were measured.

3. RESULTS AND DISCUSSION

UV-vis. spectrum of hull extracts: Fig.1 shows the variation of UV-vis. spectra of hull extracts with different extractive temperature and pH. The aqueous extracts have two absorbance peaks, one is a shoulder type peak in the range of 270-280nm, the other is more broadband about 420nm. It looks like the sum of two spectrum, which means the extracts contains several components at least two or more. Intensity of absorbance is increased with increase of extraction temperature, the highest is at 100°C. Intensity of absorbance is also affected by extraction pH.

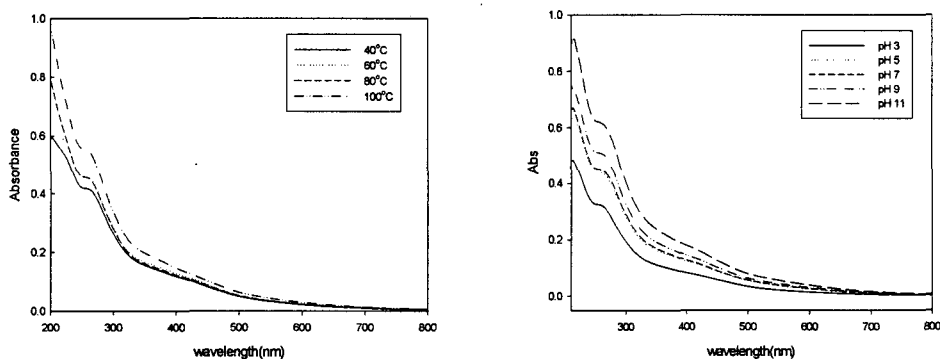


Fig.1. UV-vis. Spectra of Walnut hull Extracts at Various Extractive Conditions.

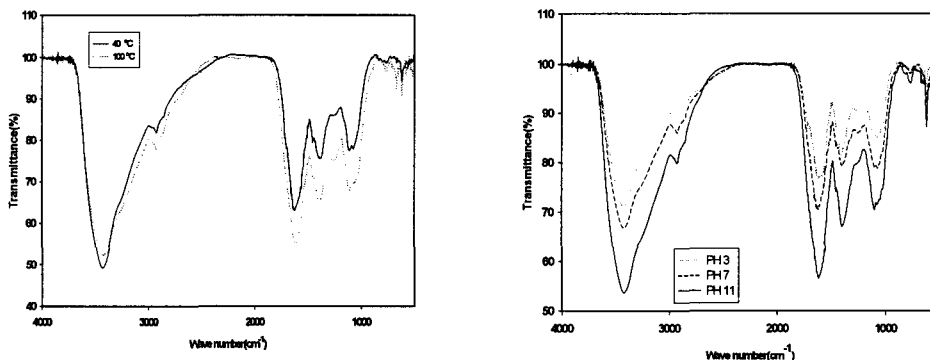


Fig.2. FT-IR Spectra of Walnut hull Extracts at Various Extractive Conditions.

FT-IR spectrum of hull extracts : Extracted colorant at 40°C and 100°C show a absorption band around 3400cm^{-1} due to the presence of hydroxyl groups. The peaks at $1700\text{-}1600\text{cm}^{-1}$, which are characteristic of aromatic compounds, represent the presence of

unsaturated ketone and benzene ring stretch. The difference between the spectra is slightly weak peak at 1710cm^{-1} shown in the case of 40°C is disappeared at 100°C .

Dyeing properties of hull extracts : Effects of dyeing time and dyeing temperatures on the dye uptake of wool fabrics with extracts at 40°C , are shown in Fig.3. K/S value increases remarkably for 60min. With the increase of dyeing temperature, K/S value increases continuously. The extracts at 100°C has more larger K/S values than the extracts at 40°C , and Freundlich type adsorption isotherm with dyeing time.

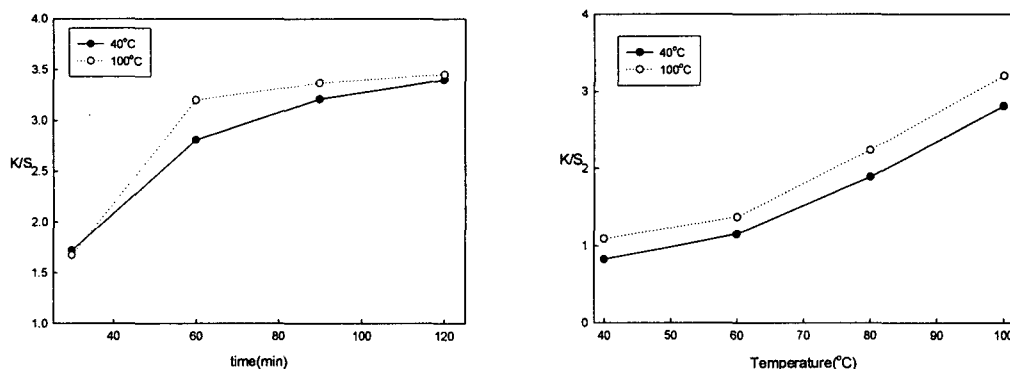


Fig.3. Effects of Dyeing Time and Dyeing Temperatures on the K/S values of Wool Fabrics with Extracts at 40°C , 100°C .

Table 1. Effect of Dyeing Time on L^* , a^* , b^* , & H, V/C of the Wool Fabric

		dyeing time(min.)	L^*	a^*	b^*	H	V/C
Extracts at 40°C		30	58.98	5.23	10.74	7.1YR	5.7/2.0
		60	52.03	6.03	12.13	7.1YR	5.1/2.3
		90	50.72	6.38	12.63	7.1YR	4.9/2.3
		120	48.48	6.56	12.36	6.8YR	4.7/2.3
Extracts at 100°C		30	59.61	5.87	11.19	6.5YR	5.8/2.1
		60	51.13	8.03	13.71	5.8YR	5.8/2.1
		90	50.34	8.09	13.90	5.9YR	4.9/2.7
		120	49.15	6.48	12.58	7.0YR	4.8/2.3

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