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DYEING OF WOOL YARNS WITH *LAURUS NOBILIS* L. BERRIES

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Abstract*: Nowadays natural dyes have been attracted by many researchers and firms due to demands on sustainable and nontoxic products. In this study the mature berries of bay laurel (Laurus nobilis L.) were collected from trees located Kuşadası Turkey. The berries dried at 25°C and % 20-25 relative humidity. Dried berries milled and extracted with ethanol. Extracted dye was used. Three mordanting procedure (pre, meta and post mordanting) and two concentrations were applied to wool yarns. Cupric sulfate, ferric sulfate, potassium dichromate and alum was used as mordant Color strength and colorimetric values were measured by Konica-Minolta 3600D spectrophotometer. Fastness to washing, perspiration and light were applied according to ISO 105C06 (A1S), ISO 105E04 and ISO 105B02 (method 2) respectively. The highest color strength (K/S) value was 16.6405 and was obtained in the case of premordanting with cupric sulfate at 2 gr/L concentration. If the a* and b* values were examined, the conditions at highest color strength, the yarns had yellow color with a reddish hue. Generally, the fastness properties were moderate and good results were obtained in the case of premordanting procedure. The results show us ethanol extract of bay laurel berries can be used for dyeing of woolen products.*

Key words : *natural dyes, mordanting, bay laurel, colorimetry, fastness*

1. INTRODUCTION

The history of natural dyes is as old as the history of humankind. Natural dyes are obtained from renewable sources such as crops, insects and so forth, and they may decrease the dependence on petrochemical sources [1]. These considerations have led to the publication of several studies on natural dyes from a number of sources [2–6]. Compounds present in extracts obtained from the most widely used natural dyes belong to a few main classes: flavonoids, anthraquinoids, indigoids and tannins [7]. *Laurus Nobilis* L. (bay laurel) is an aromatic evergreen small tree, native to the mediterranean area. Its berry is a drupe, oval shaped and the color of mature berries are black [8].

2. EXPERIMENTAL

2.1 Materials

100% wool yarn (402 tex) was supplied as ready to be dyed. Cupric sulfate was purchased from Kimetsan (Turkey); ferric sulfate, potassium dichromate and alum were obtained from SigmaAldrich (Germany). All mordants were of analytic grade. All chemicals were used without purification. Ethanol was purchased by Merck (Germany).

Mature laurel berries were collected from trees located in Kuşadası, Turkey (at sea level, latitude 37°44′ N and longitude 27°15′ E) during the lately October. The collected berries were dried in dark room. Dried berries were milled using coffe mill (Bosch).

2.2 Extraction

Extraction had been performed using ethanol at the liquor ratio of 3.9 (v/w) for 23 days. Extracted liquid was concentrated using rotary evaporator (IKA).

2.3 Mordanting

Figure 1 depicts the scheme for both mordanting and dyeing. Three mordanting procuders were applied premordanting, metamordanting, postmordanting. Rinsing was applied to yarns after mordanting using tap water. Two mordant concentrations were used, 0.5 and 2 gr/L. Liquor ratio was 1:15. Mordanting was performed using laboratory dyeing machine (ATAÇ-Turkey).

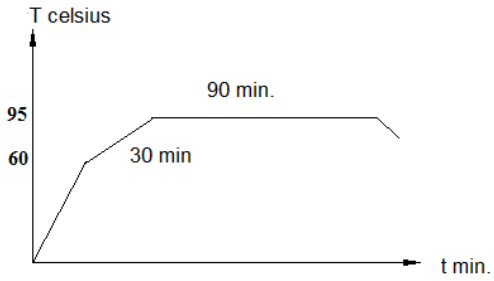

***Fig 1:**. Scheme of mordanting and dyeing*

2.4 Dyeing

Dyeing was performed using laboratory dyeing machine (ATAÇ-Turkey). The liquor ratio was 1:15. Dyeing was carried out according to scheme in Figure 1. Washing off procedure after dyeing was 5 min. warm rinsing, two times of 5 min. duration involving cold rinsing.

2.5 Color measurment

All colour measurements were performed using Minolta 3600D spectrophotometer (D65 illuminant, specular included, 10^o observer angle). The spectrophotometer was equipped with software, which was able to calculate CIEL*a*b*C*h^0 and colour strength (K/S) values from the reflectance values at the appropriate λmax for each dyeing automatically. Color strengths of fabrics were determined by using the Kubelka– Munk formula (Eq. (1)), which is shown below.

$$K/S = (1-R)^{2/}2R \quad \textbf{(1)}$$

where K is the scattering coefficient, S is the absorption coefficient,
R is the reflectance.

2.6 Fastness measurtments

Washing fastness, light fastness and perspiration fastness of the dyed yarns were performed according to ISO 105 C06 (A1S), ISO 105 B02 (method 2), ISO 105-E04 respectively. The specific tests were applied by using the following instruments: Atlas Xenotest Alpha for light fastness, Atlas perspirometer for perspiration fastness and Atlas Linitest for washing fastness. ECE non-phosphate standard detergent was used in washing fastness trials.

3. RESULTS and DISCUSSION

3.1. Colorimetric values

The colorimetric values of dyed samples were listed in Table 1. When the effect of mordant type was examined, highest L* values were obtained mordanting with Alum. Type of mordanting procedure did not affect on L* values. The parameters that affect the L* values were mordant type and concentration. The lowest L* value was obtained in the case of postmordanting with 2 gr/L cupric sulfate. Highest vividness (C*) was obtained by premordanting with 0.5 gr/L ferric sulfate. a* and b* values were compatible with the colors that obtained, which are shown in Figure2.

Table 1: *Colorimetric Values of Dyed Yarns*

Mordanting Procedure	Mordant Type	Mordant Concentration (gr/L)	L*	a*	b*	C*	Hº	K/S
-----	-----	-----	50.221	5.383	23.253	23.868	76.966	8.8679
Premordanting	Cu	0.5	47.963	5.220	25.169	25.705	78.282	11.9281
		2	43.950	3.280	25.575	25.785	82.692	16.6405
	Al	0.5	55.353	6.312	27.717	28.426	77.171	8.3552
		2	55.815	5.404	26.793	27.332	78.596	7.7749
	Fe	0.5	53.326	5.764	30.348	30.891	79.246	9.2425
		2	49.164	5.313	29.540	30.015	79.803	11.0689
	Cr	0.5	45.794	3.709	19.238	19.593	79.087	9.8690
		2	45.272	4.940	20.056	20.656	76.162	10.6765
Metamordanting	Cu	0.5	50.290	4.731	25.427	25.864	79.460	10.3942
		2	43.197	0.771	24.224	24.236	88.177	16.1770
	Al	0.5	58.733	5.311	27.912	28.413	79.228	7.0185
		2	51.458	6.899	25.071	26.003	74.615	8.3842
	Fe	0.5	49.156	3.379	20.280	20.559	80.542	8.7157
		2	43.971	5.396	20.302	21.007	75.116	12.0740
	Cr	0.5	48.705	5.451	25.797	26.367	78.069	10.3771
		2	42.438	4.532	19.903	20.412	77.172	12.0967
Postmordanting	Cu	0.5	44.964	5.975	23.687	24.429	75.843	12.8812
		2	42.215	-0.582	23.095	23.102	1.442	16.2164
	Al	0.5	54.134	6.248	26.344	27.075	76.657	8.0747
		2	54.434	5.608	25.436	26.047	77.568	7.4614
	Fe	0.5	44.649	5.085	19.613	20.261	75.464	10.5601
		2	43.720	5.978	19.036	19.952	72.566	11.6673
	Cr	0.5	45.538	6.702	24.751	25.643	74.848	12.0400
		2	42.444	5.602	22.182	22.878	75.827	14.0768

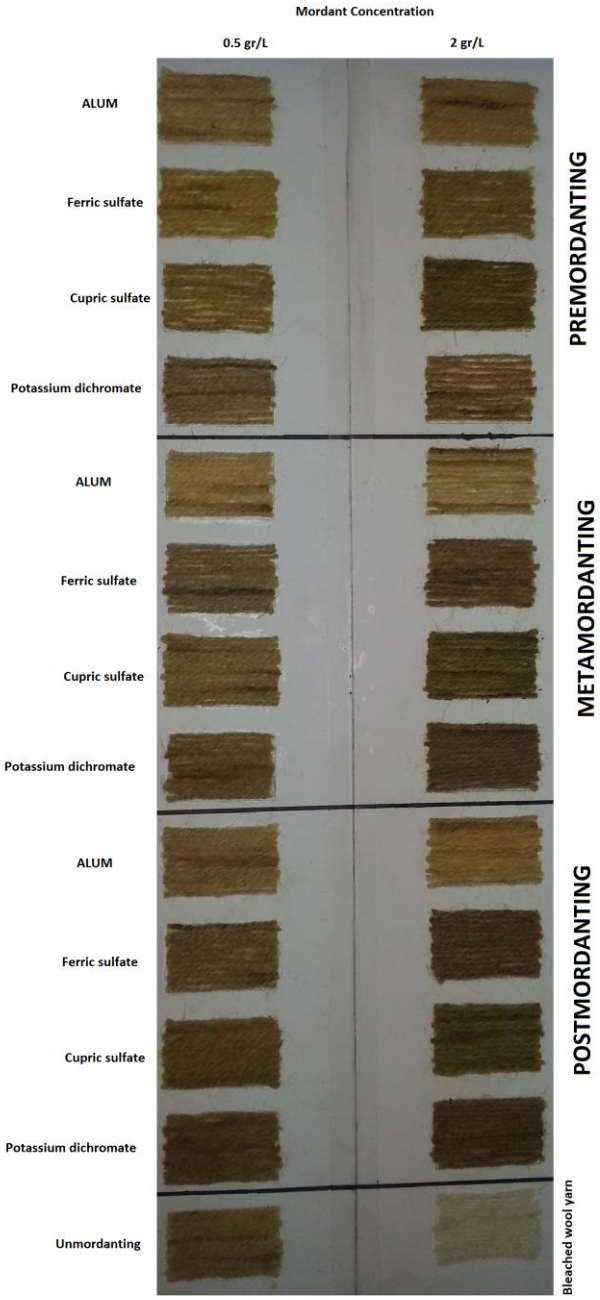

***Fig. 2**: Colour Catalgue of Dyed Yarns*

3.2. Color Strength

K/S values are listed in Table 1. Highest color strength was observed in the case of premordanting with 2 gr/L cupric sulfate. Altough mordanting procedure did not significiantly affect on K/S values, mordant type and concentrations had effect on color strength values

3.3. Fastness Properties

Washing, perspiration and light fastness properties are shown in Table 2.

***Table 2**: Fastness Properties*

Mordanting Procedure	Mordant Type	Mordant Concentration (gr/L)	Washing Fastness		Perspiration Fastness				Light Fastness
					Acidic		Basic		
			Stainning	Color change	Stainning	Color change	Stainning	Color change	
-----	-----	-----	5	3	3/4	3/4	3/4	3	3
Premordanting	Cu	0.5	5	3	4	4/5	4/5	4	6
		2	3/4	3	4	4	3/4	4/5	5
	Al	0.5	3/4	2/3	4	2/3	4	2	3
		2	4/5	2	4	3	4/5	2	3
	Fe	0.5	4	3	4/5	4	4/5	4	5
		2	4/5	3	3/4	3/4	4	4/5	3
	Cr	0.5	4/5	2/3	4/5	3	3/4	2/3	5
		2	1/2	1	2	3/4	2	2/3	6
Metamordanting	Cu	0.5	4/5	3/4	2/3	5	1/2	3/4	5
		2	1/2	3/4	1/2	2/3	2	2/3	4
	Al	0.5	4	3	3	5	3	4/5	5
		2	4	3	3/4	5	2/3	5	3
	Fe	0.5	3/4	2/3	3	4/5	1/2	3/4	4
		2	1/2	1	1/2	3/4	1	3	5
	Cr	0.5	3/4	3/4	2/3	3/4	2/3	5	5
		2	2/3	3	3/4	4/5	2	5	3
Postmordanting	Cu	0.5	4/5	3/4	3	5	2	4/5	5
		2	2/3	1/2	2/3	2/3	2	1	6
	Al	0.5	3	2/3	3	4/5	3	4/5	3
		2	2/3	2/3	2/3	3/4	3	3/4	3
	Fe	0.5	2/3	1/2	1/2	4	1/2	3/4	5
		2	1	1	1	3	1	2	5
	Cr	0.5	4	3	3/4	3/4	3/4	3	3
		2	4/5	4	3	4	2/3	4/5	3

Satisfactory results were obtained for light fastness; however wet fastness were poor. There are no correlation fastness results with mordanting procedure and type and concentration of mordants.

4. CONCLUSIONS

Bay laurel is an important plant in food and detergent industry. In this study the dyeing properties of mature berries were investigated. Satisfactory dyeing results were obtained. Highest color strength was observed in the case of premordanting with 2 gr/L cupric sulfate. The highest L* values were obtained mordanting with Alum. Vividness of yarns increased with premordanting of wool yarns. However wet fastness results were not satisfied. Light fastness of yarns were moderate.

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