Investigation on Fastness Properties and Color Measurements of Silk and Cotton Fabrics Dyed with Pulp of *Laurusnobilis*

Menekşe Suzan TEKER[1]

Atıf/©: Teker, Menekşe, Investigation on Fastness Properties and Color Measurements of Silk and Cotton Fabrics Dyed with Pulp of Laurusnobilis, Artuklu Human and Social Science Journal 2019/4 (2), 119-125.

Özet

Laurusnobilis belongs to the family Lauraceae, which is native to the southern Mediterranean region and cultivated mainly in Europe and the USA. This plant is usually cultivated as ornamental plant and as a medicinal plant. This plant, which is one of Turkey's natural floristic elements,has a wide range of usage area such as medical, food industry, perfumery etc. One of the most useful and valuable natural yields of this plant is its essential oil. After extracting essential by steam distillation, pulp of this plant can be evaluated in natural dyeing. Silk and cotton fabric samples were dyed with dry and pulp of *Laurusnobilis*.Mordant dyeing method was applied and two different mordant materials were applied with pre-mordant process.Alum [$Kal(SO_4)_2.12H_2O$] and ferrous sulphate($FeSO_4.7H_2O$) were used as a mordant. Rubbing (dry and wet) and washing fastness values were determined.Also the depths of shade were evaluated in terms of K/S and CIELAB colour difference values of the dyed fabric samples.

Keywords: *Laurusnobilis*, pulp of plant, natural dyeing, fastness values.

Laurusnobilis Posası ile Boyanmış İpekli ve Pamuklu Kumaşların Haslık Özelliklerinin ve Renk Değerlerinin İncelenmesi

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Abstract

Laurusnobilis, Güney Akdeniz bölgesine özgü ve çoğunlukla Avrupa ve ABD'de yetiştirilen Lauraceae ailesine ait bir bitkidir. Genellikle süs bitkisi ve şifalı bitki olarak yetiştirilmektedir. Türkiye'nin doğal floristic elementlerinden biri olan bu bitki, tıp, gıda endüstrisi, parfümeri vs. gibi geniş bir kullanım alanına sahiptir. Bu bitkinin en faydalı ve değerli doğal ürünlerinden biri uçucu (esansiyel) yağıdır. Buhar damıtması ile özütlendikten sonra, bu bitkinin geriye kalan posası (özü), doğal boyamada değerlendirilebilmektedir. İpek ve pamuklu kumaş örnekleri, *Laurusnobilis* bitkisinin posası ile boyanmıştır. Mordanlı boyama yöntemi uygulanmış olup, iki farklı mordan maddesi ön mordanlama işlemi ile uygulanmıştır. Şap [$Kal\ (S0_4)_2.12H_20$] ve demir sülfat ($FeS0_4.7H_20$) mordanları kullanılmıştır. Sürtünme (kuru ve ıslak) ve yıkama haslığı değerleri incelenmiştir. Kumaş numunelerinin K/S ve CIELAB değerleri ölçülmüştür.

Anahtar Kelimeler: *Laurusnobilis*, posa, doğal boyama, haslık değerleri

[1] Dr. Öğr. Üyesi, Akdeniz Üniversitesi, Güzel Sanatlar Fakültesi, Moda ve Tekstil Tasarımı Bölümü.
ORCID: orcid.org/0000-0001-9328-7722.
Geliş/Received: 17.12.2019, **Kabul/Accepted:** 20.12.2019

INTRODUCTION

Laurusnobilis belongs to the family Lauraceae, which is native to the southern Mediterranean region and cultivated mainly in Europe and the USA(Fiorini et al., 1997,s.91).This plant is usually cultivated as ornamental plant and as a medicinal plant (Caputo et al., 2017, s.930). Laurel (*Laurusnobilis*) is an evergreen tree cultivated in many warm regions of the world, particularly in the Mediterranean countries (Longo and Vasapollo, 2005, s.8063; Derwich et al., 2009, s.3818, Ünal et al. 2016).*Laurusnobilis*is one of the most useful and valuable natural products essential oil (Chahal et al., 2017, s.1153).Laurel is natural floristic elements of Turkey and widely used in industrial area such as medicine, perfumery, food flavoring, pharmacefoods, cosmetics, aromatherapy, phytotherapy, spices, nutrition and sources of aroma chemicals (Zeković et al. 2009; Buchbauer, 2000).The leaves and essential oil of this plant have antibacterial, antimicrobial,antifungal, anti-oxidant, antiseptic, antiperspirant, analgesic and anti-inflammatory, anti-ulcer, acaricidal and antiproliferativeactivities (Dadalioglu and Evrendilek, 2004; Chahal et al., 2017; Derwich et al., 2009; Caputo et al., 2017; Al-Kalaldeh et al., 2010; Sayyah et al., 2003; Simić et al., 2003). There are many studies about all of these properties of this plant and its essential oil.Also have been used for stomach discomfort relieving, diabetic treating, migraine prevention, fatigue, indigestion, menstrual irregularities, insect repellent and to treat epilepsy, neuralgia and Parkinsonism.The another area of usage of this plant is as characterization of bio-oil and bio-char and works showed that the bio-oil obtained from laurel extraction residues could be an important liquid fuel source and chemical feedstocks (Ertaş and Alma, 2010). Natural dyeing is also included in many different usage areas. Anthocyanin in fruit of *Laurusnobilis*is used as a natural dyestuff for the food, medicine and cosmetic industry (Türkmen et al., 2004; Goktas et al., 2008). Also branches with flower, berries and leaves are used as a dyestuff(Gökhan and Derya, 2016).

Synthetic dyes produced from petroleum based raw materials are widely used in textile. As a result of the stringent environmental standards imposed by many countries in response to the toxic and allergic reactions associated with synthetic dyes, there has been growing interest in the use of natural dyes in textile applications (Deo and Desai, 1999). The growing awareness of the organic value of environmentally friendly products has led consumers to regain interest in the use of textiles dyed with environmentally friendly natural dyes (preferably natural fiber product) (Samanta and Konar, 2011).Natural dyes exhibit better biodegradability and are generally more environmentally compatible, providing an important alternative for conscious consumers (Deo and Desai, 1999). But the raw material used in natural dyeing and process standardization must be adhered to the industrially existing system. At this point, it is necessary to evaluate pulp of essential oil extracted plant. In terms of dyestuff content, the method used in essential oil extraction process is very important. Because the dyestuff content of plant will change with the any chemicals or boiling. Therefore steam distillation method is the most suitable method for using them as a dye source. Steam distillation is unquestionably the most frequently used method for the extraction of essential oil from plants (Baser and Buchbauer, 2015). This distillation is suitable for *Laurusnobilis*(Zeković et al., 2009; Özek, 2012; Lira et al., 2009). Essential oil extraction procedure provides that dyestuff in the plant remains stable. Starting from this point of view, pulp of *Laurusnobilis* used as a dyestuff.

Material and Method

Pulp of *Laurusnobilis* was obtained from İnanTarım ECODAB in Antalya. The company produces EO of *Laurusnobilis* by steam distillation. Plant leaves were separated from their stem parts and air-dried. Silk fabric weighing 64 g/m^2 and cotton fabric weighing 72 g/m^2 were used. The dyeing was carried out mordants, using pre-mordanting method. Alum [$Kal(SO_4)_2.12H_2O$] and ferrous sulphate($FeSO_4.7H_2O$) mordantswere used. Dry and wet rubbing fastness values determined according to TS EN ISO 105-X12 and wash fastness values were determined according to TS EN ISO 105-C06/A1S. According to Grey Scale, 1-2-3-4-5 are rating classes also half rating values can be used like 4-5 (1- very poor, 2-poor, 3-fair, 4-good and 5-excellent). Fastness test results are listed below according to mordanting agent in Table 1. Two mordanting procedure (pre and metamordanting) applied to silk and cotton fabric samples. Color strength and colorimetric values were measuredby 3nh NS800 (D65, specular inclusion, 10°) spectro-photometer (Table 2).

Results and Discussion

Washing and rubbing fastness values are listed and classified according to mordants in Table 1.Rubbing fastness values (dry and wet) according to TS EN ISO 105-X12 and washing fastness values according to TS EN ISO 105-C06/A1S.

Rubbing fabric and samples were conditioned under standard atmosphere conditions for 24 hours and then 16 mm cylindrical rubbing foot used for rubbing fastness test. In wet rubbing, cotton rubbing cloth was used after absorbing 100% water. Environmental conditions of the experiment were 20±2°C and 65% relative humidity. According to Grey Scale, 1-2-3-4-5 are rating classes also half rating values can be used like 3-4 or 4-5 (1- very poor, 2-poor, 3-fair, 4-good and 5-excellent). Fastness test results are listed below according to mordant agent in Table 2,3,4,5.

The washing fastness properties of the dyed samples varied between 4 and 5, staining on test fabrics are 4-5, except for staining on silkmordanted with alum. The rubbing fastness of the dyed samples varied generally between 4-5 and 5, wet and dry rubbing fastness values for silk fabric are excellent. For cotton fabric alum mordanting gives highest values for rubbing fastness values.

Table 1. Washing and rubbing fastness values

Fabric	Mordant	Washingfastness						Rubbingfastness	
		Staining on wool	Staining on acrylic	Staining on polyester	Staining on polyamide	Staining on cotton	Change in color	Dry	Wet
Silk	Alum	5	5	5	5	5	4-5	5	5
	Ferroussulphate	5	5	5	5	4-5	4-5	5	5
Cotton	Alum	5	5	5	5	4-5	4-5	5	5
	Ferroussulphate	5	5	5	5	4-5	3-4	4-5	4-5

The colorimetric measurements of fabrics were performed using a 3nh NS800 (D65, specular inclusion, 10°) spectro-photometer. The values used by CIE are called L*, a* and b* and the colour measurement method is called CIELAB. L* represents the difference between light (where L*=100) and dark (where L*=0). a* represents the difference be-tween green (-a*) and red (+a*), and b* represents the difference between yellow (+b*) and blue (-b*)[16]. The colour difference ΔE was calculated by the Equation (1):

$$\Delta E=\sqrt{(\Delta L)2 +(\Delta a)2+(\Delta b)2} \quad (1)$$

The K/S (color strength) value was calculated by Equation (2):

$$K/S= (1-R)2 / 2R \quad (2)$$

where R is the observed reflectance.

The colorimetric values for dyed fabrics are listed in Table 2. Analysis of the data shows that using ferrous sulphateheptahydrate mordant gives darker shades. Silk fabric mordanted with ferrous mordant causes the darkest shade. The fabrics showed reddish shades, cotton fabrics showed more reddish shades then silk fabrics. When b* values are examined, alum mordanted silk fabric showed more yellowish shades then the other fabric samples. The values of a* were lowest and b* was maximal for silk and cotton fabric samples. For C* values, this can be said that fabric samples are generally bright. Alum mordanted silk fabric has brighter shades then other fabrics. It was observed that, the color strength (K/S) value was good at silk fabricmordanted with alum. The value h° varies between 63 to 71, values are close to each other's and samples generally have a yellow tone.

Table 2. *Colorimetric values*

Fabric	**Mordant**	**Mordan-tingMethod**	**L***	**a***	**b***	**C***	**h°**	**K/S**
Silk	Alum	Pre	77.960	8.423	24.730	26.126	71.191	1,437941
	Ferroussulphate		67.099	8.708	18.357	20.317	64.623	0,794433
Cotton	Alum	Pre	76.074	9.657	19.739	21.974	63.931	0,042445
	FerrousSulphate		77.817	9.297	21.313	23.252	66.433	0,019639

CONCLUSION

Laurusnobilis plant is a very important essential oil source in Turkey. Used in many different industries, the most important waste of this plant is extracted after the process of taking the essential oil. Anatolia has been cultivated for centuries for the natural dye plants, but after the synthetic dyes the agricultural part has declined considerably. This was perhaps the most influential factor in the use of natural dyes. This has led to the search for alternative ways to reach natural dye plants. These alternative pathways also allow the plants to be recycled in the recycling system. For this reason, it is very important to evaluate the plant pulp from which essential oil is taken in natural dyeing.

Two different mordant substances and two different fabric types are dyed (silk and cotton).Premordanting dyeing method was applied. Alum and ferrous sulphatemordants are selected. As a result of the dyeings made with this plant, washing and rubbing (wet and dry) fastness values were found to be quite high. Fastness values and color measurements indicate that this pulp of plant is an important source of dyes.

REFERENCES

Al-Kalaldeh, J. Z., Abu-Dahab, R., and Afifi, F. U. (2010). Volatile oil composition and antiproliferative activity of Laurusnobilis, Origanumsyriacum, Origanumvulgare, and Salvia triloba against human breast adenocarcinoma cells. *Nutrition Research* 30(4): 271-278.

Baser, K. H. C., Buchbauer, G., eds. (2015). *Handbook of essential oils: science, technology, and applications.* Boca Raton: CRC Press.

Buchbauer, G. (2000). The detailed analysis of essential oils leads to the understanding of their poperties. *Perfumer & Flavorist* 25: 64-7.

Caputo, L., Nazzaro, F., Souza, L. F., Aliberti, L., De Martino, L., Fratianni, F., and De Feo, V. (2017). Laurusnobilis: Composition of essential oil and its biological activities. *Molecules* 22(6): 930-40.

Chahal, K. K., Kaur, M., Bhardwaj, U., Singla, N., and Kaur, A. (2017). A review on chemistry and biological activities of Laurusnobilis L. essential oil. *Journal of Pharmacognosy and Phytochemistry* 6(4): 1153-61.

Dadalioğlu, I., and Evrendilek, G. A. (2004). Chemical compositions and antibacterial effects of essential oils of Turkish oregano (Origanumminutiflorum), bay laurel (Laurusnobilis), Spanish lavender (Lavandulastoechas L.), and fennel (Foeniculumvulgare) on common foodborne pathogens. *Journal of agricultural and food chemistry*, 52(26): 8255-8260.

Deo, H. T., and Desai, B. K. (1999). Dyeing of cotton and jute with tea as a natural dye. *Coloration Technology* 115(7-8): 224-7.

Derwich, E., Benziane, Z., and Boukir, A. (2009). Chemical composition and antibacterial activity of leaves essential oil of Laurusnobilis from Morocco. *Australian Journal of Basic and Applied Sciences* 3(4): 3818-24.

Ertaş, M., and Alma, M. H. (2010). Pyrolysis of laurel (Laurusnobilis L.) extraction residues in a fixed-bed reactor: Characterization of bio-oil and bio-char. *Journal of Analytical and Applied Pyrolysis* 88(1): 22-9.

Fiorini, C., Fouraste, I., David, B., and Bessiere, J. M. (1997). Composition of the flower, leaf and stem essential oils from Laurusnobilis. *Flavour and fragrance journal* 12(2): 91-93.

Goktas, O., Duru, M. E., Yeniocak, M., and Ozen, E. (2008). Determination of the color stability of an environmentally friendly wood stain derived from laurel (Laurusnobilis L.) leaf extracts under UV exposure. *Forest Products Journal* 58(1/2): 77-80.

Gökhan, E. and Yılmaz, D. (2016). Dyeing of wool yarns with laurusnobilis l. Berries. Annals of the University of Oradea. *Fascicle of Textiles* 17(2): 53-8.

Lira, P. D. L., Retta, D., Tkacik, E., Ringuelet, J., Coussio, J. D., Van Baren, C., &Bandoni, A. L. (2009). Essential oil and by-products of distillation of bay leaves (Laurusnobilis L.) from Argentina. *Industrial Crops and Products*, 30(2): 259-64.

Longo, L., and Vasapollo, G. (2005). Anthocyanins from bay (Laurusnobilis L.) berries. *Journal of agricultural and food chemistry* 53(20): 8063-7.

Özek, T. (2012). Distillation Parameters for Pilot Plant Production of Laurusnobilis Essential oil. *Records of Natural Products*, 6(2): 135-43.

Samanta, A. K., and Konar, A. (2011). *Dyeing of Textiles with Natural Dyes. In Natural Dyes*, edited by E. Akcakoca Kumbasar, 29-56. Rijeka: InTech.

Sayyah, M., Saroukhani, G., Peirovi, A., and Kamalinejad, M. (2003). Analgesic and anti-inflammatory activity of the leaf essential oil of Laurusnobilis Linn. *Phytotherapy Research* 17(7): 733-6.

Simić, M., Kundaković, T., and Kovačević, N. (2003). Preliminary assay on the antioxidative activity of Laurusnobilis extracts. *Fitoterapia* 74(6): 613-6.

Ünal. K., Çiçek, F., Oğur, E., Tutar, Ünal. K., Çiçek, F., Oğur, E., Tutar, M., and Ayas, F. (2016). Türkiye'de Yayılış Gösteren Defne (Laurusnobilis L.) Populasyonlarının Meyve Özellikleri. *Anadolu, J. of Aari*, 26 (1), 1 – 16, Mfal.

Zeković, Z. P., Lepojević, Z. D., and Mujić, I. O. (2009). Laurel extracts obtained by steam distillation, supercritical fluid and solvent extraction. *Journal of natural products* 2: 104-109.