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A Research on the Colors Obtained From Sage (*Salvia Officinalis L.)* and Their Fastness Values

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Abstract : Sage is a plant of the family *Labiteae*, the subfamily *Sstchyoideae*, and the genus *Salvia*. The aim of this research is to determine colors obtained from sage with different mordants and these colors fastness values such as light, friction, wet and dry water drop fastness, and to form a color catalogue. Firstly, 15 dyeings were done with several mordants at a rate of 3% according to wool weight and one dyeing was done without mordant. As a result of these dyeing processes, it was determined that copper sulfate and potassium-bicromate mordants gave the best colors. Therefore, 14 dyeings were done by mixing copper sulfate (Cs) mordant with the other mordants at the equal ratio. The same process was applied with potassium-bicromate (Pbc) mordant. Totally 44 dyings were done with the colors obtained from these dyeings and a color catalogue was formed. Obtained colors which are used mostly in carpets were green, dried rose, brown and their tones. The light fastness values of the colors obtained from sage were generally between 1 and 6, friction fastness values were generally between 1-2 and 4-5. The water drop wet fastness values were generally between 3 and 5, and the water drop dry fastness values were generally between 4-5 and 5. It was found that when mordants were used as lonely color tones were very different but light fastness values were low, though mordants were used as mixed color tones were limited but light fastness values were high.

Key words: Sage, vegetable dying, craft, carpet

Adaçayından *(Salvia officinalis L.)* Elde Edilen Renkler ve Bu Renklerin Bazı Haslık Değerleri Üzerinde Bir Araştırma

Özet : Adaçayı *Labiteae* familyasının, *Sstchyoideae* alt familyasının, *Salvia* cinsine ait bir bitkidir. Bu araştırmanın amacı farklı mordanlar ve mordanlama yöntemleri ile adaçayı bitkisinden elde edilen renkleri belirlemek , bu renklerin bazı haslık değerlerini tayin etmek, ve bir katalog oluşturmaktır. Bu amaçla adaçayı kullanılarak, araştırmada belirtilen mordanların her biri yün ağırlığına göre % 3 oranında alınmış ve 15 mordanlı, bir mordansız olarak toplam 16 boyama yapılmıştır. Bu boyamalar sonucunda, bakır sülfat (Cs) ve potasyum-bikromat (Pbc) mordanlarının adaçayı ile en iyi renkleri veren mordanlar olduğu belirlenmiştir ve önce Cs mordanı sabit tutulup diğer mordanların her biri ile eşit oranda karıştırılarak 14 boyama yapılmıştır. Aynı muamele Pbc mordanı ile de tekrarlanmıştır. Bu araştırmada toplam 44 boyama yapılarak adaçayı bitkisinden elde edilen renklerin bir kataloğu oluşturulmuştur. Adaçayı bitkisi ile halıcılıkta en çok kullanılan renkler olan yeşil, gül kurusu, kahverengi ve tonları elde dilmiştir. Renklerin ışık haslık değerleri çoğunlukla 1 ile 6 arasında bulunmuştur. Sürtünme haslık değerleri çoğunlukla 1-2 ve 4-5 arasındadır. Bu değerler iyi ve orta düzeydedir. Islak su damlası haslık değeri 3 ve 5 arasında olup bu değerler iyi ve orta düzeydedir. Kuru su damlası haslık değeri 4-5 ve 5 arasında olup, bu değerler iyi düzeydedir. Mordanlar tek başına kullanıldığında renk tonları çok çeşitli ancak ışık haslık düzeyleri düşük, karışık olarak kullanıldığında ise renk tonları sınırlı ancak ışık haslık düzeyleri daha yüksek bulunmuştur.

Anahtar kelimeler: Adaçayı, bitkisel boyacılık, el sanatları, halı

Introduction

It may be relevant to our history to remind ourselves that the bright colours were almost all produced by vegetable dyes. The same is true for the ancient and precious Persian rugs that retain their glowing and intense hues for a couple of hundred years or more. The Indians used vegetable dyes for their porcupine quills, which are after all a form of hair.

Vegetable dyeing has been used and applied in dyeing of textile products for centuries until discovering chemical dyes. So many kinds of plants are used for obtaining dye. One of these plants is sage (*Salvia officinalis*).

The most important active matter of the sage leaves is volatile oil that is between 0.5% and 2.5%. If composition of volatile oils is examined, it seems that the main matter is thujon besides cineole, camphor, borneol, linalol, pinene and bornylaetate (Baytop 1993).

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It is used usually for medicine to several aims such as carminative, diuretic, antihidrotic, antihistaminic, analgesic, expectorant, disinfectant, gargle etc. Sage has no side effects in recommended doses. Its usage is in the form of tablet, or as drop, tea, and volatile oil. In addition, it is used in cosmetic for perfumes. Sage has widespread usage area and also it is used for dyeing of wool carpet and rug yarns. But, there is no research about dyeing properties of sage.

Nearly all dyes "take" better after a process known as *mordanting* which also helps set the color and makes it more fade-proof. And sometimes the process enriches the color as well.

The aim of this research is to determine colors obtained from sage with different mordants and mordanting methods, to determine these colors fastness values such as light, friction, wet and dry water drop fastness. In this research a catalogue was formed by colors obtained from sage with a total of 44 dyeings. It has been expected that, this research will be a guide for carpet weavers from the standpoint of desired colors that use vegetable dyed wool yarns.

Material and Method

Material

The materials of this research are sage (*Salvia officinalis L.*), wool carpet yarns (2,5 Nm and without dyed or white) and 15 mordants. These mordants are as follows: alum of aluminum (Aa), copper sulfate (Cs), zinc clorur (Zc), ferro-sulfate (Fs), tinyclorur (Tc), calcium chloride (Cc), alum of crime (Ac), potassium-bicromate (Pbc), potassium-hydroxide (Ph), sodium-hydroxide (Sh), sodium-clorur (Scl), sodium-sulfate (Ssa), sodium-sulfite (Ssi), potassium-bitartarate (Pbt) and tannin (Tn).

Sage is a plant of the family *Labiteae*, the subfamily *Sstchyoideae*, and the genus *Salvia*. It grows up to 60 cm, rarely 100 cm; it is a kind of plant like bushes. It is stipule rooted and sweet smelling. Its roots hold the ground firmly; these roots go to the deep of the ground. Upper-soil stems are very branchy. Leaves have long stems and their shapes change from long egg to narrow elliptical. Also the color of leaves change from whitish gray to silver color. Its leaves are downy. Generally leaf edges are very little deep cloven and their surface is wrinkle. Sage blooms in June-September. Its flowers are connected to the top of the stem. The colors of flowers are bluish purple, pink or white. Flower wisteria includes 4-8 flower heaps and in the shape of ear. There is sepal which has bell shaped, long cloven, veany and downy. And there is petal, which has upper and lover lips. The colors of petal are light violet and rarely white. Flowers smell like other green parts of the plant. Its fruit is almost spherical and 2-3 mm long, 2 mm wide. The surface of fruit is dotted and its color changes from dark brown to black. There are at least 3 kinds of Salvia, which are different from one another. But, it is not easy to discriminate these species' culture forms from one another (Baytop 1993).

Method

Mordanting wool carpet yarns

Pre-mordanting method has been applied for mordanting wool carpet yarns. Mordants are used in two different ways. One of them is to take one mordant alone at a rate of 3%. Second of them is to take two mordant by mixing in equal amount (1.5%-1.5%, a total of 3%).

Firstly, wool carpet yarns were mordanted with mordants by each one separately indicated in the Material chapter. For this aim, mordant was taken according to wool weight at a rate of the 3%. Mordant was melted in the one-liter tepid water. Then, previously damped wool yarn was boiled in mordanted water for one hour. At the end of the time mordanted wool yarn that was taken out of the water was squeezed and prepared for dyeing.

Secondly, after dyeings were done, it was determined that Cs and Pbc mordants were given the best colors. Then once Cs mordant was taken as fixed mordant (at a rate of 1.5%) and mixed with the other mordants separately (at a rate of 1.5%), in equal amounts (totally 3%) according to wool weight. Mordant mixture was melted at a rate of 1/50 in tepid water. Damped wool yarn was boiled in the mordanted water for one hour. At the end of the time mordanted wool yarn that was taken out of the water was squeezed and prepared for dyeing. The same process was applied for Pbc mordant.

Preparation of dye extract

To obtain the penetration of dye matter to water, dried sage plant was broken up into small pieces. Sage was taken according to wool weight at a rate of the 100%. Pure water was used according to wool weight at a rate of the 1/50. And then plant pieces were boiled in this water for one hour. At the end of time plant remnants were filtered and putted away from the water. In this way dye extract was obtained.

Dyeing without mordant

Previously damped wool yarn was boiled in dye extract for one hour. During the boiling decreased water is added equal to vaporized amount. Then it was cooled, rinsed with cold water and dried at shading and airy place.

Dyeing with mordant

Mordanted wool yarn was boiled in the previously prepared dye extract for one hour. Then, it was cooled, rinsed with cold water and dried at shading and airy place.

Naming the colors

Naming obtained colors was arranged subjectively. Obtained colors with these methods were named by the commission consisted of specialists of Ankara University Agricultural Faculty Home Economics Department. For the naming, dyed wool yarn samples were spread on a white ground where the sunlight comes from the side and they formed into groups according to their colors and tone differences. And also Harmancıoğlu (1955) was considered for the naming of the colors.

Light fastness determination

Light fastness determination was done according to TS 867 prepared by TSE (For Dyed or Pressed Textiles Color Fastness Testing Methods- Color Fastness Determination Methods Facing Sunlight) (Anonymous 1984a) and DIN 5033 (Fabmessung Begriffe der Fabrmetrik) (Anonymous 1970).

Friction fastness determination

Friction fastness determination was done according to TS 717 prepared by TSE (For Dyed or Pressed Textiles Color Fastness Determination Methods-Determination of Color Fastness According to Friction) (Anonymous 1978a) and TS 423 (Using Methods of the Gray Scale for Sum up the Staining "leaking of dye "and Discoloring "Chancing of Color", in the Determination of Color Fastness of Textiles) (Anonymous 1984b).

Water drop fastness determination

Water drop fastness determination was done according to TS 339 prepared by TSE (Color Fastness Determination Facing Water Drop) (Anonymous 1978b) and TS 423 (Using Methods of the Gray Scale for Sum up the Staining "leaking of dye " and Discoloring "Chancing of Color", in the Determination of Color Fastness of Textiles) (Anonymous 1984b).

Results and Discussion

The Colors obtained from sage

The colors obtained from sage by two different pre-mordanting application were seen Table 1, 2 and 3.

Table 1. Colors obtained from sage by pre-mordanting method

Name of the Mordant	Mordant rate (%)	Obtained colors
Alum of aluminum	3	The Nile green
Copper sulfate	3	Ooze olive oil color
Zinc clorur	3	Dark Nile Green
Ferro sulfate	3	Earth color
Calcium chloride	3	Milky brown
Tinychlorur	3	Lemon mould color
Alum of chrome	3	Dark brownish green color
Potassium-bicromate	3	Pickled wine leaf color
Potassium- hydroxide	3	Milky brown
Sodium-hydroxide	3	Camel hair
Sodium-clorur	3	Dark milky brown
Sodium-sulfate	3	Light milky brown
Sodium-sulfite	3	Light milky brown
Potassium-bitartarate	3	Green cream
Tannin	3	Dried rose
Without mordant	-	Light milky brown

Analyzing Table 1, it is seen that the Nile green, ooze olive oil color, dark Nile Green, earth color, milky brown, lemon mould color, dark brownish green color, pickled wine leaf color, milky brown, camel hair, dark milky brown, light milky brown, light milky brown, green cream, dried rose, light milky brown colors are obtained from sage by pre-mordanting method.

Analyzing Table 2, it is seen that the henna green, dark pickled wine leaf, dark cumin, cumin, light cumin, dark khaki, reddish soil, dark camel hair, greenish brown, light earth colors are obtained from sage by mixing fixed Copper sulfate (Cs) mordant with the other mordants.

Table 2. Colors obtained from sage by mixing fixed Copper sulfate (Cs) mordant with the other mordants

Name of the Mordant	Mordant rate (%)	Obtained colors
Cs + Alum of aluminum	1.5+1.5	The henna green
Cs + Zinc chlorure	1.5+1.5	Dark pickled wine leaf
Cs + Ferro sulfate	1.5+1.5	Dark pickled wine leaf
Cs + Calcium chloride	1.5+1.5	Dark cumin
Cs + Tinychlorur	1.5+1.5	Cumin
Cs + Alum of chrome	1.5+1.5	Light cumin
Cs + Potassium-bicromate	1.5+1.5	Dark khaki
Cs + Potassium- hydroxide	1.5+1.5	Reddish soil
Cs + Sodium-hydroxide	1.5+1.5	Dark camel hair
Cs + Sodium-clorur	1.5+1.5	Cumin
Cs + Sodium-sulfate	1.5+1.5	Greenish brown
Cs + Sodium-sulfite	1.5+1.5	Cumin
Cs + Potassium-bitartarate	1.5+1.5	Cumin
Cs + Tannin	1.5+1.5	Light earth color

Table 3. Colors obtained from sage by mixing fixed Potassiumbicromate (Pbc) mordant with the other mordants

Name of the Mordant	Mordant rate (%)	Obtained colors
Pbc + Alum of aluminum	1.5+1.5	Dark khaki
Pbc + Copper-sulfate	1.5+1.5	Dark khaki
Pbc + Zinc clorur	1.5+1.5	Dark khaki
Pbc + Ferro sulfate	1.5+1.5	Dark khaki
Pbc + Calcium chloride	1.5+1.5	Nutshell green
Pbc + Tinychlorur	1.5+1.5	Dark khaki
Pbc + Alum of chrome	1.5+1.5	Dark khaki
Pbc + Potassium- hydroxide	1.5+1.5	Dark khaki
Pbc + Sodium-hydroxide	1.5+1.5	Dark khaki
Pbc + Sodium-clorur	1.5+1.5	Dark khaki
Pbc + Sodium-sulfate	1.5+1.5	Dark khaki
Pbc + Sodium-sulfite	1.5+1.5	Dark khaki
Pbc + Potassium-bitartarate	1.5+1.5	Dark henna green
Pbc + Tannin	1.5+1.5	Dark khaki

Analyzing Table 3, it is seen that the dark khaki, nutshell green, dark henna green colors are obtained from sage by mixing fixed Potassium-bicromate (Pbc) mordant with the other mordants. These colors can be used in hand made carpets and rugs widely.

Light, friction and water–drop fastness values of the colors obtained from sage

Fastness, characteristic desired in textile products, is resistance of a color against to outer effects. The most desired fastnesses in textile products are light friction and water drop fastnesses. Blue wool scale and gray scale are used for appreciating of fastnesses. Blue wool scale is used for light fastness and appreciated between 1 and 8. It shows that the first one is the lowest degree, and the 8^{th} one is the best degree. Gray scale is used for all the other fastness appreciation between 1 and 5. And it shows that the first one is the lowest degree, and the 5^{th} one is the best degree. Light, friction and water–drop fastness values of the colors obtained from sage are shown in Table 4, 5, and 6.

Analyzing Table 4, it is seen that, the value of light fastness is between 1 and 5 by pre-mordanting method and without mordant. While Cs mordants gives the value of 5, Cc, Tc, Ph, Scl, Ssi, Ssa, Tn mordants and without mordant give the value of 1, which is the lowest value. These values show that the light fastness values of the colors obtained from sage are low. Also from the Table.4, it is seen that the values of friction fastness changes between 2 and 3-4. Ac and Tn give the lowest value, 2, whereas, Scl, Ssa, Ssi, Pbt and without mordant give the best value, 3-4. These values are middle. From the same table, it is seen that, the values of water drop wet fastness change between 3 and 5. Ssi gives the lowest value, 3, whereas, Tc and Ph give the best value, 5. These values are middle and good. The values of water drop dry fastness are good with all mordants.

Table 4. Light, friction and water –drop fastness values of the colors obtained from sage by pre-mordanting method

Name of the Mordant	Mordant rate (%)	Light fastness	Friction fastness	Water drop fastness	
				Wet	Dry
Alum of aluminum	3	2	3	4-5	5
Copper sulfate	3	5	3	4	5
Zinc clorur	3	3	3	4-5	5
Ferro sulfate	3	4	2-3	3-4	5
Calcium chloride	3	1	3	5	5
Tinychlorur	3	1	3	3-4	5
Alum of crome	3	2	2	4	5
Potassium-bicromate	3	4	3	3-4	5
Potassium- hydroxide	3	1	3	5	5
Sodium-hydroxide	3	2	3	3-4	5
Sodium-clorur	3	1	3-4	3-4	5
Sodium-sulfate	3	1	3-4	3-4	5
Sodium-sulfite	3	1	3-4	3	5
Potassium-bitartarate	3	2	3-4	4	5
Tannin	3	1	2	4	5
Without mordant	-	1	3-4	3-4	5

Table 5. Light, friction and water-drop fastness values of the colors obtained from sage by mixing fixed copper sulfate (Cs) mordant with the other mordants

Name of the Mordant	Mordant rate (%)	Light fastness	Friction fastness	Water drop fastness	
				Wet	Dry
Cs + Alum of aluminum	1.5+1.5	3	4-5	5	5
Cs + Zinc chlorure	1.5+1.5	4	3	3	5
Cs + Ferro sulfate	1.5+1.5	5	1-2	3-4	5
Cs + Calcium chloride	1.5+1.5	5	2-3	3-4	5
Cs + Tinychlorur	1.5+1.5	3	3	3	5
Cs + Alum of chrome	1.5+1.5	3	1-2	3	5
Cs + Potassium- hydroxide	1.5+1.5	2	2-3	3	5
Cs + Sodium-hydroxide	1.5+1.5	1	2	3-4	5
Cs + chlorure	1.5+1.5	5	3	3-4	5
Cs + Sodium-sulfate	1.5+1.5	3	3-4	3	5
Cs + Sodium-sulfite	1.5+1.5	5	3	3-4	5
Cs + Potassium-bitartarate	1.5+1.5	3	3	4	5
Cs + Tannin	1.5+1.5	3	2-3	3-4	5

Table 6. Light, friction and water-drop fastness values of the colors obtained from sage by mixing fixed potassium-bicromate (Pbc) mordant with the other mordants

Name of the Mordant	Mordant rate (%)	Light fastness	Friction fastness	Water drop fastness	
				Wet	Dry
Pbc + Alum of aluminum	1.5+1.5	4	2	3	5
Pbc + Copper-sulfate	1.5+1.5	5	2	3	5
Pbc + Zinc chlorure	1.5+1.5	3	2-3	3	5
Pbc + Ferro sulfate	1.5+1.5	5	2	3	5
Pbc + Calcium chloride	1.5+1.5	4	3	3-4	5
Pbc + Tinychlorur	1.5+1.5	5	2-3	3	5
Pbc + Alum of chrome	1.5+1.5	3	2	5	5
Pbc + Potassium- hydroxide	1.5+1.5	4	2-3	3	5
Pbc + Sodium-hydroxide	1.5+1.5	3	2-3	3-4	5
Pbc + chlorure	1.5+1.5	3	3	3-4	5
Pbc + Sodium-sulfate	1.5+1.5	4	2	3	5
Pbc + Sodium-sulfite	1.5+1.5	5	3	3-4	5
Pbc + Potassium-bitartarate	1.5+1.5	6	3	3-4	5
Pbc + Tannin	1.5+1.5	4	3	3	5

Analyzing Table 5, it is seen that, light fastness values of the colors obtained from sage by mixing fixed Copper sulfate (Cs) mordant with the other mordants change between 1 and 5. Cs+Sh mordant mixture gives the lowest value, 1, whereas, Cs+ Fs, Cs+Cc, Cs+Sc and Cs+Ssi mordant mixtures give the highest value, 5. These values are low and middle. Also from the Table.5, when the friction fastness values are analyzed, it is seen that the values change between 1-2 and 4-5. Cs+Fs and Cs+Ac mixtures give the lowest value, 1-2, whereas, Cs+Aa mixture gives the best value, 4-5. These values are middle. From the same table, it is seen that, the values of water drop wet fastness change between 3 and 5. Cs+Zc, Cs+Tc, Cs+Ac, Cs+Ph mixtures give the lowest value, 3, whereas, Cs+Aa mixture gives the best value, 5. These values are middle and good. Water drop dry fastness values are found in good level with all mordants.

Analyzing Table 6, it is seen that, light fastness values of the colors obtained from sage by mixing fixed Potassium-bicromate (Pbc) mordant with the other mordants change between 3 and 6. Pbc+Zc, Pbc+Ac, Pbc+Sh and Pbc+Sc mordant mixtures give the lowest value, 3, whereas, Pbc+Pbt mordant mixture gives the highest value, 6. These values are middle and good. Also from the Table.6, when the friction fastness values are analyzed, it is seen that, the values change between 2 and 3. These values are middle. From the same table, it is seen that, the values of water drop wet fastness change between 3 and 5. Pbc+Ac mixture gives the best value, 5. It gives middle and good values with the others, 3 and 3-4. Water drop dry fastness values are found as 4-5 and 5. These values are good.

Conclusion

In this research, when mordants were used alone, very different kinds of colors were obtained from sage such as green, brown, dried rose and tones. Brown and green tones were obtained by mixing fixed Cs with the other mordants separately. Very dark green color and tones were obtained by mixing fixed Pbc with the other mordants separately. These colors are desired and used preferably in hand woven carpets and rugs. Due to these good colors it has been recommended that sage can be used in vegetable dyeing.

The light fastness values of the colors obtained from sage were generally between 1 and 6. When mordants were used alone, light fastness values were at low levels, while, mordants were used as mixture they were at the best levels. When the friction fastness values of the colors obtained from sage were examined, it was found that they were generally between 1-2 and 4-5. These values were good or middle. When the water drop wet fastness values of the colors obtained from sage were generally between 3 and 5. These values were good or middle. The water drop dry fastness values of the colors obtained from sage were generally between 4-5 and 5. These values were good.

Consequently it has been considered that wool carpet yarns dyed with mixed mordants method can be used in wool carpet yarns. In addition, sage in respect of color tones and fastness values can be suitable for dyers and carpet makers.

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