NATURAL DYESTUFFS OF TURKEY IN CULTURAL POINT OF VIEW

TULAY GULUMSER¹, ASLI DEMIR² ESEN OZDOGAN³ NECDET SEVENTEKIN¹

¹Ege University Textile Engineering Department, 35040 Bornova, Izmir Turkey, tulay.gulumser@ege.edu.tr
²Emel Akın Vocational High School, İzmir Turkey, asli.demir@ege.edu.tr

Anatolia has been one of the leader centers of textile and trading from three thousand years with its rich culture and has always been very convenient with its climate and earth for natural dyestuffs. French achieves indicate that the first samples of Turkish carpets could be seen in the beginning of XIVth century. In 1750’s, Rubia tinctorum L. was famous in French as “Turkish Red”. Its agriculture and usage in Anatolia was so high and was also imported to the other countries. Dyestuffs have been used by numerous civilizations from the ancient times. Natural dyestuffs were widely used esp. in Turkish carpets and kilims which took great place in our culture, until the development of synthetic dyestuffs at 1850’s. The beginning of the usage of synthetic dyestuffs and increasing demands of Turkish carpets decreased the importance of natural dyestuffs. Nowadays by the development of new global ecological trends, the importance of natural dyestuffs increased. In Textile Engineering Department of Ege University, many researches were made about dyeing of textile fibers by natural dyestuffs. As the result of comprehensive studies, natural dyeing can be used in organic textile production. These results have great values for the cultural, environmental, economical aspects.

Keywords: natural dyestuffs, organic textile, Rubia tinctorum L.

HISTORY OF TURKISH NATURAL DYESTUFFS

Anatolia has a rich culture and convenient conditions for the agriculture of natural dyestuffs. The climate and the earth in Anatolia are very special. There are 11,000 plant species in the whole Europe, 9,000 plant species in Turkey, 3,000 of them are endemic. The colors, designs and weaving techniques of Turkish carpets and kilims give us great evidences for our cultural heritage [1].

The trading of Anatolia to the European countries has begun in very early years. The old documents proved that Turkish carpets were famous in French even at the beginning of XIVth century. Wool or silk carpets could be found in the early French achieves these carpets could be traced and in the old German paintings. The exportation of carpets to all over the Europe increased at XVIII th and XIX th centuries. In this period the exportation from Usak for example reached to 50-60 thousand square meters. Until that period the usage of natural dyestuffs was in their golden eras, but unfortunately the occurrence of synthetic dyestuffs and increasing demands of Turkish carpets revealed a crisis among Turkish farmers dealing with the agriculture of natural dyestuffs after 1850’s. The usage of cotton in weft yarns of Gordes and Demirci carpets decreased the quality more.

When the highest level of Turkish natural dyestuff production and exportation was examined, it could be seen that the root named “madder”, Rubia tinctorum L. was very famous in French in 1750’s and known as “Turkish Red”. The cultivation of madder was made in Anatolia for many years. Two third of the exportation of madder in the world was made by Ottoman Empire itself at that time [2].

Until the end of 19th century, not only the carpets and kilims, but also the woven materials made of silk and cotton were dyed by natural dyestuffs in Anatolia. The increasing usage of synthetic dyestuffs, decreasing usage of hand weaving technology and growing customer demands decreased the consumption of natural dyestuffs.
gradually. In recent years an interest to these dyestuffs begins to rise in cultural and ecological points of view. Today many researches and projects about this subject have begun an increasing usage trends have been going on [3].

THE IMPORTANCE OF TURKISH NATURAL DYESTUFFS

The popularity of the natural dyestuffs rise again and this may bring some questions to the mind. Are there unique colors among the palette of natural dyestuffs that can not be formed by synthetic dyestuffs? Don’t they ever fade? Are they so inexpensive or easy to find [3]? The answers to all of these questions are not satisfactory, enough. The main reasons are cultural and ecological. The colors of natural dyestuffs colors come from the cultural heritage of Anatolia. These colors come from the harmony of Turkish carpets and kilims with the nature. And these colors reflect the color tastes of Anatolian people for centuries. The methods of dyeing are mostly traditional, attracting great attention again, nowadays.

From the ecological point of view, natural dyestuffs are good alternatives to synthetic ones. They can easily be used in the production of organic textiles by adapting the dyeing methods to the new systems. Environmental friendly textile goods attract the attention to many people and the number of this group is increasing day by day. Synthetic dyestuffs, various kinds of auxiliary agents, waste water load, great energy and water consumption are weak points of modern dyeing methods. Natural dyestuffs may overcome most of the problematic issues by suitable techniques.

The appearances of textile materials dyed with natural dyestuffs are also interesting for conscious people. In many regions, it is a common practice to expose naturally dyed carpets and kilims to the sun so that the colors fade gradually and gracefully with great harmony and beauty. But the synthetic dyestuffs don’t have this property. Synthetic dyestuffs of high light fastness don’t fade, but the ones of low fastness fade with dull colors and poor quality. An ordinary eye can feel this difference easily and the common taste of the people is directly towards the natural dyed materials [4].

TYPES OF TURKISH NATURAL DYESTUFFS

Turkish natural dyestuffs can be grouped into two groups; vegetable and animal sourced dyestuffs. Vegetable sourced ones are obtained from the roots, stems, leaves and flowers. They can be used in fresh or dried form. Animal sourced ones are obtained from the female insects containing dyestuffs. They are dried, grained and used in granule form. Various dyestuffs give different colors and these colors are also affected from the mordents, metal salts used to bind the dyestuffs chemically. Red, purple, blue, yellow, brown, black, orange and green colors can be obtained with these dyestuffs [5].

Here are some examples of the famous Turkish natural dyestuffs below:

- Madder (*Rubia tinctorum L.*): It is used to obtain the red color and was known as “Turkish Red”, centuries ago in French. The roots of this plant are used as dyestuffs. Old roots contain more dyestuffs compared to the young ones. *Rubia tinctorum L.* plant grows wildly in Central and Western Anatolia and a two year old plant can be about half to one meter tall.
• Safflower (Carthamus tinctoria L.): Safflower was used to obtain red and yellow colors. The leaves and the flowers are dyestuff sources. It is also an oil plant and can be found in Central, South and East Anatolia.

• Kermes (Kermes vermilio Planc): Kermes is an insect and lives on a plant named Quercus cocifera L. This insect lives in Mediterranean countries, and in Turkey, too. There are some other types named Polish Kermes and Ararat Kermes, the latter one is grown in Turkey, too. The female kind of the insect is used for dyestuff production.

• Woad (Isatis tinctoria L.): Blue tones are produced from this plant and the depth of the color depth depends on the boiling time of the leaves to extract the dyestuff. It is found along the edges of fields and grows wildly in Central and Western Anatolia.

• Camomile (Anthemis tinctoria L.): Yellow colors, especially the bright ones can be obtained from this plant. It can be found all over Anatolia. The flowers, fresh or dried, can be used as dyestuffs.

• Daisy (Anthemis chia L.): An annual plant that grows in spring wildly in everywhere. The yellow colors of the carpets of West and South Anatolia were mostly dyed by the flowers of this plant.

• Weld (Reseda luteola L.): The usage of this plant as a natural dyestuff is very old. In the carpets of 16th century, the colors with this dyestuff were found. It grows on the high regions and the part of the plant over the soil is used to obtain yellow colors.

• Buckthorn (Rhamnus petiolaris Boiss.): An important dyestuff plant growing on the lands with altitudes up to 1000 meters especially on the regions of carpet weaving. The unripe fruits, fresh or dried are used to obtain yellow colors. Deep yellow toned obtained from the dried fruits are mainly used for dyeing silk.

• Labada (Rumex crispus L): It can be found in many countries and it is a herbaceous plant used for yellow and light brown colors. The roots and seeds contain dyestuff material.

• Walnut (Juglans regia L.): Walnut tree is famous and used for many purposes in Turkey. Turkey produces 15-20% of the world's walnut crop. The most famous brown color can be obtained from the leaves and hulls of that tree. Fresh or dried forms of them can be used. The applications of the dyestuff are possible with or without mordants.

• Pomegranate (Punica granatum): Pomegranate tree grows in the mild regions of Western, Southwestern, and Northeastern Anatolia. The fresh or dried skins of the fruit are used for dyeing. Obtained color changes from yellow to brownish yellow and from brown to black according to the type of the mordant used in dyeing.

• Valonia Oak (Quercus aegilops): This oak tree normally contains very low tannin, but the acorn cups contain about 45% tannin and a black dye can be obtained from them [4, 5].

MORDANTS USED IN DYEING WITH NATURAL DYESTUFFS

A mordant is a metal salt used to bind the dyestuff coordinatively over the metal ion especially to the wool fiber. Mordants also help to grow the size of the dyestuff
molecule, so decrease the solubility of the dyestuff in water. For these reasons dyeing with mordants give extreme fastness properties and according to the type of the mordant, different colors with the same natural dyestuff can be obtained. Wool is the most suitable fiber to use the mordant, then silk comes and it is also possible to use mordants in dyeing cotton fibres with natural dyestuffs by special techniques. In cotton dyeing, mordants have to be precipitated on the fibers by converting them into insoluble form, or the fibers should be treated with oil or tannic acid and then treated fabric should be impregnated with the mordant, whereby the metallic mordants are held on to cotton via oil or tannic acid.

Mordants include certain metal salts of aluminium, chromium, copper, iron, iodine, potassium, sodium, or tin.

The three methods used for mordanting wool fibers are:

- Pre-mordanting (onchrome): The fiber is treated with the mordant and then dyed.
- Meta-mordanting (metachrome): The mordant is added in the dye bath itself.
- Post-mordanting (afterchrome): The dyed fiber is treated with a mordant [6].

Today there is a trend of discussing about the natural dyestuffs because of the use of mordents. Some people believe that there are no natural dyes because of the use of mordents. However that’s not true because in mordanting process of the wool, the fiber takes all the metal salts in the liquor and these metal salts are totally used to bind dyestuffs. The complex formed is not a harmful one and a strong bond is occurred within the fiber and the dyestuff. In many traditional methods of natural dyeing, mordents are from the natural chemicals of the earth, are not synthetically produced, so when they are added to natural dyestuff bath they act as a fixing agent [4]. In recent studies, the mordents that do not contain toxic heavy metals are chosen in order to eliminate the suspects in the ecological point of view.

The most common mordents used with Turkish natural dyestuffs are Potassium Aluminum Sulphate (KAl(SO$_4$)$_2$.12H$_2$O), Copper Sulphate (CuSO$_4$), Iron II Sulphate (FeSO$_4$), Iron III Sulphate (Fe$^{3+}$(SO$_4$)$_3$) and FeCl$_3$. Nowadays new types of mordents are also tried to remove the suspects from the minds about ecology.

**OUR STUDIES ABOUT NATURAL DYESTUFFS**

In Textile Engineering Department of Ege University, many researches and projects have been made about dyeing of textile fibers by natural dyestuffs for 25 years. Dyeabilities, colors, fastness and strength values were searched with many natural dyestuffs, mordents and fibers. In the beginning, the studies were mostly about wool fibers and the starting point was traditional methods. Then other fibers such as cotton, silk and even synthetic fibers were tried. Recently besides traditional methods, modern techniques were also used and the evaluations in ecological point of were started.

Here are some natural dyestuffs and dyed samples below. In the studies, Potassium Aluminum Sulphate (KAl(SO$_4$)$_2$.12H$_2$O), Iron III Sulphate (Fe$^{3+}$(SO$_4$)$_3$) and FeCl$_3$ were used as mordants. Madder (Rubia tinctorum L.), Valonia Oak (Quercus aegilops) and Weld (Reseda luteola L.) were used as dyestuffs.
CONCLUSION

Dyeing with natural dyestuffs is a valuable cultural heritage in Turkey. This traditional way of dyeing textile materials mustn’t be allowed to disappear and should be developed into many fields by using the advantages of this method. These dyestuffs can be applied to many fibers, other than wool, even synthetics with suitable techniques. Choosing the proper mordant and process enables production of ecological textiles. One of very important subjects in organic production is “organic cotton” in the latest years. The usage of natural dyestuffs appropriate to the criteria of “organic cotton” can be a good change for the producers and productions in the industrial scale can also be possible. This branch gives possibilities to make goods of high added value and have a special group of customers.

As a result it could be said that, natural dyestuffs have a significant place in coloring textiles with its unique properties, cultural importance, environmental friendly aspects and economical values. In the future their popularities seem to increase and their application methods will be developed.

REFERENCES
