

Natural Dyes

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People have relied on insects, leaves and roots of plants for thousands of years to impart color onto textiles. References regarding natural dyes are peppered throughout ancient history from the madder-dyed robes of King Tut to biblical references of scarlet linens dyed with insects. It wasn't until William Henry Perkin serendipitously discovered a lavender dye artificially produced from a constituent of coal tar in 1856 that synthetic dyes began to replace natural dyestuffs.

Today, natural dyes have almost no economical importance and are used in limited quantities by craftsmen. However, with the consumer's growing appetite for eco-friendly apparel, it might be prudent to check-out natural dyes.

NATURAL DYES

There are three primary sources for natural dyes—plants, animals and minerals. Regardless of the source, natural dyes can be broken down into two categories—substantive and adjective. Substantive dyes, also referred to as direct dyes, become chemically fixed to the fiber without the aid of any other chemicals or additives. Indigo and some lichens are substantive dyes. For “green” dyed garments it is preferable to use substantive natural dyes.

Adjective dyes, also referred to as mordant dyes, require an added substance known as a mordant to make the dyes colorfast. Most natural dyes are adjective dyes. The type of mordant used in the dyeing process affects the color produced.

Some of the natural dyes that have been extensively used throughout history and are still available today are discussed in the following text. The advantages and disadvantages of natural dyes will also be reviewed.

Indigo



Indigo is a blue dye derived from the leaves of a leguminous plant. Natural indigo is probably the oldest dye known to humans—the oldest fragments of cloth are dyed with it. The Romans used indigo to make an ink called indicum. It is a dye known to all cultures of the world. Indigo was the most widely used dye in America during the 18th and 19th centuries.

Depending on the dyeing procedure, light blues to deep navy colors can be obtained. Of the natural dyes, indigo has some of the best fastness properties—and in fact it is the only natural blue dye of permanence. It was the original dye of the "Levi's" blue jeans—becoming the trademark color for durability. Indigo is insoluble in water. During the dyeing process it is made soluble. Once the fabric is dipped into the indigo dye bath, dye is deposited into the fibers. When the fabric is removed the air oxidizes the indigo, returning it to its original natural insoluble state—permanently locking it in to the fiber.

Madder



Madder is considered the “Queen of the Reds.” It is one of the oldest and most frequently used natural dyes. It was the main source of red dye in large part because it could be easily cultivated. The secret of producing Turkey red—a deep rich red color—from madder was a closely guarded secret for centuries throughout Central Asia. Madder has an extensive history in Turkey, India and Iran where it is still used. The red coats worn by British soldiers during the American Revolutionary War were dyed by using the roots of madder.

Madder is a member of the coffee family. It is an herbaceous plant with an extensive fibrous root system in which the concentrated red colorant is stored. The root is beaten into a paste. Depending on the mordant it can produce deep

orange-red to deep red colors. Madder can be used to dye cotton, wool and silk.

Cochineal



In 1518, the Spaniards discovered the indigenous people of Mexico using cochineal “seeds” as a dye. They later found that the dye did not derive from seeds but the cochineal bug. The dye was used throughout Mexico and Guatemala where the bug thrived on the nopal or opuntia cactus. As the insect matured the wingless dye-yielding females were swept off the leaves to which they were attached and plunged into hot water. The dead insects were then laid in the sun or placed in a bag and put in the oven to dry. After the insects were dried they were ground into a fine powder.

It takes 70,000 dried insects to produce a pound of dye. An acre of nopal cactus yields approximately 250 to 300 pounds of insects. Cochineal is more costly than madder and is easily adulterated. Dark burgundy to bright red to soft lilac and pink can be obtained from cochineal. Both wool and silk are successfully dyed with cochineal when tin or alum is used as the mordant.

Lac



Lac was used for centuries in India. It is derived from the dried bodies of an East Indian insect. The female insects attach themselves to the twigs of trees where they reproduce rapidly, exuding a thick gummy red resinous substance.

It was the dye used to produce crimson for Persian carpets. In 1796, it was exported to England and a few years later to the United States where it was widely used because of its low cost and dull but very fast red colors.

Fustic



Fustic dye comes from a tree in the mulberry family and therefore is often referred to as mulberry. The dye is obtained from the hardwood of the tree. Historically, fustic was considered the best source for yielding a yellow color. Various mordants can be used. Today, potassium bichromate is the most popular mordant. The dye that is derived from fustic is colorfast but a bit dull. Fustic can be used to dye cotton, wool and silk.

Chrome Yellow



Chrome yellow is a mineral dye. It was used extensively throughout the second half of the 19th and into the 20th century. It was considered to be the best yellow dye for cotton. It can produce shades ranging from very pale canary yellow to deep orange.

Weld



Weld is an annual or biennial herb that grows in light sand and rocky soils and can tolerate poor chalky soils as well. It was the most commonly used dye in England until the introduction of synthetic dyes. Traditionally, weld was cultivated throughout Europe for its yellow dye. Today, it still flourishes on embankments, beside railways and roads.

The upper part of the plant, including the leaves and seeds, was used to produce a variety of bright yellow hues. Large amounts of the weld plant are required to dye fabrics. The color produced is dependent on the fiber and mordant. A chrome mordant used with either wool or cotton produces an olive-yellow hue. A titanium mordant used with silk produces bright yellow. Wool, silk, cotton and linen can all be successfully dyed with the weld plant.

Turmeric



Turmeric is historically one of the most famous and brightest of all the naturally occurring yellow dyes. It is extracted from the fresh or dried rhizomes of the turmeric plants which are native to India. It is the only yellow substantive dye. It can be used to dye silk, wool and cotton. It is sensitive to light, soap and alkali.

Logwood



The logwood tree grows naturally in Central America, Mexico and northern parts of South America. Depending on the mordant used a variety of violets, silvers, greys and black shades can be produced. Historically, the most important application of logwood was dyeing fabric black. A synthetic substitute for producing black dye was not found until the beginning of World War II.

Orchil



Orchil is a very old dye that was initially obtained from several different varieties of the lichens found on coastal rocks and cliffs along the Mediterranean coast. Orchil is one of the few substantive dyes which produce a wide range of purple shades. Mordants can be used to yield other colors. For example, mordanting with tin produces a dull colorfast red shade.

Brazilwood



Brazilwood refers to a dye obtained from several different trees and shrubs from a wide variety of origins. The dye has been used for hundreds of years and was used extensively in American colonial times. Today, brazilwood dye can still be purchased. Clear Christmas reds to deep garnet red can be obtained with an alum mordant. A variety of pinks are produced when tin is used.

Catechu



Catechu, also known as cutch, was first introduced around 1800 in Germany. It is a vegetable dye that produces a variety of brown shades on silk. Yellow-brown is produced when alum is used; reddish-brown is produced when a chrome mordant is used. A brownish-black can be obtained with iron and a medium brown with copper.

Historically, a number of sources were used to obtain catechu dye. Bengal catechu is derived from the heartwood and pods of a leguminous tree. Bombay catechu is obtained from betel nuts from an Asian palm. It has historically been used to dye cotton and silk.

Walnut, Black Walnut, Butternut Trees



The husks, leaves and bark of the branches and roots are used to produce shades of brown. Wool dyed with fermented walnut husks has long been admired for its beauty and fastness. The Confederate soldiers' uniforms during the Civil War were dyed with butternut. Dyes derived from these trees are considered to be nontoxic, easy to use and colorfast.

Eclipta



Eclipta is a common weed which produces fluorescent green shades on silk. Cotton can also be dyed with Eclipta. Depending on the mordant, a variety of green shades can be produced. Eclipta dye exhibits relatively good fastness to rubbing, light and washing, making it well suited for cotton.

ADVANTAGES

Utilizing natural dyes to impart color onto fabric has a number of advantages over synthetic dyes.

- Natural dyes are generally more eco-friendly than synthetic dyes. Synthetic dyeing procedures can be polluting and certain diazo dyes are carcinogenic.
- Almost all natural dyes are free of azo compounds which are carcinogenic.
- Most natural dyes are known antioxidants.
- Clothes dyed with natural dyes have the potential to be sold at a higher price.
- Depending on the dyeing procedure and the type of mordant used, a variety of colors can be produced using one natural dye source. Each natural dye source provides an amazing diversity of shades. From one dye you may obtain between 5-15 varying colors and shades.
- Natural dyes are seen as more eco-friendly since, unlike their synthetic counterparts, they are all derived from natural sources.
- Inconsistencies in color could be marketed as unique or one of a kind.

DISADVANTAGES

The quality and effectiveness of natural dyestuffs depends upon a great many factors. And, although there is a trend toward eco-friendly processes, natural dyes have some disadvantages.

- It takes time to extract the color from raw materials.
- Natural dyes have limited availability.
- Unlike synthetic dyes that are created in a laboratory, natural dyes are obtained from plants and are dependent on growing seasons.
- Although natural dyes initially produce bright colors in a variety of shades, fabrics tend to fade quicker than fabrics colored with synthetic dyes when exposed to light and home laundering.
- Consistency of color is a challenge when dyeing with natural dyes. No two dye lots are identical, due to impurities in the natural dyes.
- Some mordants may present unacceptable levels of toxicity. The more toxic mordants, such as chromium and tin, are required for some of the brighter colors. It is important to note that not all mordants are toxic, for example, alum is relatively safe to use, though not entirely non-toxic.
- Although some fibers, such as silk and wool, can be colored simply by being dipped in the dye, others fibers such as cotton require a mordant.
- Synthetic fibers usually cannot be dyed with natural dyes.

CONCLUSION

Today, the vast majority of dyes and pigments are produced synthetically. Colors produced from synthetic dyes are more consistent from batch to batch than colors produced by natural colorants. However, natural dyes are an eco-friendly way to impart almost any color to a textile product. With the recent interest in environmental concerns, natural dyes might be a good way to produce unique products with a green slant.

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August 2009