Natural Dyes and Medicines

I have been spinning protein fibers such as wool and silk into yarn and dyeing them with natural dyes for about 20 years now. I've also done a lot of reading on the subject and believe that anyone interested in natural drugs should study the history of the dye industry and obtain hands-on experience in the use of what we now refer to as vegetable dyes but which in reality, just like natural medicines, consist of substances obtained from all of nature including animals, vegetables and minerals. (Liles p.2) (Blumgarten p.4)

The story of vegetable dyes and herbal medicines is intricately connected. The organic, synthetic chemistry that gave birth to the pharmaceutical industry at the end of the 19th century and the beginning of the 20th was developed by scientists working to discover and synthesize both dyes and drugs. In fact, it was the accidental discovery of the first synthetic dye by Henry Perkin in England in 1856 that ushered in the age of synthetics. Perkin was trying to synthesize the antimalarial drug quinine when he discovered a mauve dye popularized by Queen Victoria. (Liles p. 2, Androsko p.9) Chemists noticed the antibacterial properties exhibited by some dyes in test tubes and investigated their uses as therapeutic agents. Many proved to be quite useful. Paul Ehrlich, the German drug developer, systematically studied aniline dyes and modified them for use as drugs (CHEMISTRY IN MEDICINE p.589-591).

There are very good reasons why synthetic dyes replaced natural ones. They are the same reasons why natural remedies were replaced by synthetic drugs. First, there are very few things found in nature that will, without modification, produce useful results either as a dye or as a drug. Second, compared to natural products, synthetics give predictable results and are usually far easier to manufacture, especially in commercial quantities in standardized potencies free from impurities.

Natural Dyes

The natural world is full of exquisite colors yet very few have ever been successfully transferred from plants to fibers. Most just give a brown or beige color when used as a fabric dye. Others produce a strong pretty color, but it is not fast, meaning that it either washes out, fades away when exposed to light or rubs off. Of all the beautiful reds and pinks we see in nature, the only two sources of good dyes for those colors ever discovered by man were madder (Rubia tinctorium), a root, and hard shell insects from the Coccidae family, such as cochineal (Dactylopius coccus). (Liles p. 102-104). The only fast dye for purple was obtained from snails of the genera Murex and Purpura, the first being found in the Mediterranean and the second off the coasts of Nicaragua and Mexico. The Phoenicians perfected the famous royal purple or Tyrian dye from this source but the snails were depleted by the Middle Ages and the dye industry that had been centered around Tyre, Sidon, Carthage, Ventura and Cadiz died out as a result. (Liles p.155) Until the discovery of Prussian Blue (Ferric ferrocyanide) by German chemists in 1788 (Liles p.48), indigo (Indigofera tinctoria) was the only source of a fast blue. (Liles p.43) From about Roman times till around 1800 weld (Reseda luteola) was the most reliable yellow dye used. Around 1775 it was discovered that the inner bark of the American black oak tree (Quercus velutina) also produced a good, fast yellow. (Liles p.43) Chrome yellow (lead chromate) was introduced in the middle of the 19th century. However, it was poisonous, not to the people who wore clothing

dyed with it, but to those who manufactured it. Liles speculates that many must have suffered from lead poisoning. (Liles p. 34) Greens were produced by overdyeing blues and yellows.

Then there was the problem of standardization. In 1971 Rita Adrosko wrote about natural dyes in NATURAL DYES AND HOME DYEING, "Craftsmen are becoming increasingly enthusiastic about this out-dated and time-consuming process for one of the reasons that manufacturers rejected it: difficulty of standardization. Natural dyestuffs produce offbeat, one-of-a-kind colors. No two dye lots are identical, each having subtle differences due to impurities peculiar to the particular plant material used. Thus the very characteristics of natural dyes that often made them the despair of earlier dyers appeal to today's craftsmen searching for the unique." (p.1) While uniqueness may be desirable to an artist, it is loathed by the physician and pharmacologist.

The problem of course with raw botanicals is that the numerous chemical ingredients that make up plants vary widely. Not only do the variations occur between plants of the same species, but also from part to part of the same plant so that, for instance, in madder the dye is contained in the roots, not the leaves. The type and quantity of chemicals present are affected by such things as soil, species, weather, time of harvest as well as the part of the plant used. The manner in which they are stored and processed also has a profound effect.

On p. 13 of "Growing Herbs and Plants For Dyeing" published in 1982 by Betty E.M. Jacobs, Ms. Jacobs says that, "Color varies greatly with plants grown in different areas, due to mineral content of the soil, and various other factors of growth."

Dyers learned by trial and error what to pick and when and where to pick it. They passed down their knowledge from generation to generation often keeping trade secrets from outsiders. In 1986 on p. 172 in the "The Colour Cauldron" Su Grierson states that, "A generation ago in the Hebridean Island of Uist, in one district all the women collected their crotal (the dark kind) from one particular hill and had done so as far back as anyone could remember, simply because that hill had always been known to produce the brightest colours." Grierson also writes that the Gaelic name for St. John's Wort, a minor traditional dye plant and a major botanical drug today, is Ashlasan Challum-chille or Armpit Package of Columba because it was believed that it warded off evil and brought peace and plenty to those who carried it secretly under their left armpit as St. Columba had done. She also notes that there are several species of Hypericum in Scotland. Proper identificatiion was important since only Hypericum perforatum gave a good color. (p.149-150)

Dyers, of course, used color as a control. They kept trying to determine which plant, which part of the plant, which species, which growing conditions and what time of harvest would produce the color closest to the one they wanted, but they also had many other variables to worry about such as the water and utensils used. Dyes prepared in a tin pot give a color different than the same ones prepared in an iron pot. To obtain the desired color time after time, the dyer had to know all this. If he didn't get what he was looking for, he knew that something was wrong with the raw materials used or with the manufacturing process and had to figure out what and adjust it.

In an effort to standardize colors, dye plants were often cultivated rather than gathered wild. Many were grown commercially. In order to get a standard color

from a particular species of dye plant 400 years ago, the farmer would have had to have worked empirically by selecting & cultivating plants that produced a dye that got closer and closer to the color he wanted. He would also have had to have tried growing the plants under different conditions to see what type of soil, etc. gave the best results. When he reached his goal, he would then have had to have maintained the results by always growing the same species under the same conditions using color as his control. If he got a shade he didn't want, he would have had to have tried to determine what had gone wrong, corrected it and started again. By keeping good records and adjusting the variables, he learned by experience how to obtain the desired color, but it wasn't easy or exactly the same each time. Even today it is not possible to precisely match color from batch to batch, not even with synthetic dyes.

Contrary to the popular current belief that all things natural are safe and marvelous, many natural dyes are toxic and cannot be safely produced by craftspeople where food is prepared or disposed of near a source of drinking water. That is why most dye manuals caution against using cooking utensils to create dyes with. According to Liles, Scheele's green or arsenic sage was introduced about 1770. Although it was extremely poisonous, it was used to dye cotton, linen and paper. Liles states that "Napier complained bitterly in 1875 that the dye was still being used and that it poisoned the maker, the winders of yarn dyed with it, and the person using the dyed article." (p.145) He adds that it was particularly dangerous when used on wallpaper and that there is good evidence that the arsenic from the wallpaper in his bedroom on St. Helena killed Napoleon and poisoned some of his servants. (p.145-6) [Liles sources are: Napier, J.N. 1875. A MANUAL OF DYEING AND DYEING RECEIPTS. London: Charles Griffin and Co. and A PRACTICAL TREATISE ON THE ARTS OF DYEING AND CALICO PRINTING, (BY AN EXPERIENCED DYER). 1846. New York: Harper.]

I did a MEDLINE search to see if I could find the evidence that Liles was referring to regarding Napoleon's wallpaper. I could not. What I did come up with indicates that Napoleon was not killed by the arsenic in the wallpaper in his bedroom. However, there is quite a bit of evidence that given the right conditions wallpaper dyed with arsenic could, and probably did, cause illness and death in a matter of weeks.

Traditional crafts were not always simple. Creating some colors with natural dyes was very complicated and could not be done outside a commercial facility. Regarding the production of Turkey red, Liles states, "The process was much more complicated than that for simple madder red. It originally involved some thirteen to twenty tricky steps to be executed over a three- to four-month period. Ingredients used in various of the steps (from 1600 to 1880) included cattle, sheep, or camel dung; rancid olive oil, castor oil, sesame seed oil, palm oil, fish oil, or lard; soda ash, tannin, alum, chalk, madder, and sometimes blood. The brightening process, which produces the brilliant fiery shades, included boiling the dyed article, sometimes for several hours under pressure with soap solutions, and sometimes with tin salts. Even the best dye houses (usually set up for Turkey red dyeing alone) had reasonably frequent failures." (p.111)

As a result of all these difficulties from 1856 when Perkin discovered the first synthetic dye, natural dyes were gradually replaced by synthetics. (Androsko p.9) By the 1880's Americans could purchase synthetic dyes in country stores across the nation. By 1915 synthetics had virtually replaced naturals in American industry and homes (Liles p.2).

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