TECHNOLOGY

A Century of Color

Discovery of the first synthetic dye was made 100 years ago. William Henry Perkin's synthesis of mauve was the beginning of our modern dye industry.

By DOROTHY SCHRIVER

➤ THE ENTIRE DYE INDUSTRY and the world of chemistry is celebrating the 100th anniversary of the discovery of mauve, the first synthetic dye, by William Henry Perkin in England in 1856.

The modern dye industry began with the discovery of mauve. This was done accidentally by Perkin when he was just 17 years old, while he was experimenting in an attempt to synthesize quinine.

During one experiment in which he was using aniline, a product of coal tar, as one of the raw materials, a dark-colored mass was formed. This was mauve, the first of the many colorful aniline dyes, now prepared from black, sticky, foul-smelling coal tar. When this mass was dissolved in alcohol, a violet liquid resulted that would dye silk and wool.

Perkin pursued his experiments until he had the chemical process under control, patented it, and established in England the first factory in the world for the manufacture of dyes.

Production Difficulties

The discovery of the first synthetic dye was much simpler than its production on a commercial scale. Aniline oil, which was needed for the manufacture of mauve, was not available. When Perkin attempted to produce it from coal tar, he found this was not practical.

He then developed a new procedure of obtaining aniline oil from nitrobenzene. While working out the best process for producing the dye, several explosions occurred. Eventually most of the difficulties were overcome and the first lot of mauve was commercially available in December, 1857.

During the next ten years, Perkin continued research on dyes and improved on his original mauve by a different chemical procedure. He also brought out other dyes known as Perkin's green, alizarin, dahlia, aniline pink, magenta, etc.

The 100th anniversary of the creation of synthetic dyes is culminating in the Perkin Centennial, sponsored by the American Association of Textile Chemists and Colorists, from Sept. 10 to 16.

To point up this celebration, mauve is the color used in printing this issue of SCIENCE NEWS LETTER.

Synthetic dyes are usually made from one or another of five hydrocarbons, benzene, toluene, xylene, napthalene and anthracene. The best source for these hydrocarbons is coal tar, obtained from the high-temperature heating of coal for the manufacture of illuminating gas or of coke.

The hydrocarbons thus obtained are usually separated from other compounds and from each other by heating, and then are further purified.

The various dyestuffs are built up from these hydrocarbons in successive stages until a very complex molecule has been made. It is possible for the color chemist to build up dyestuff molecules having almost any required structure and containing the particular atomic groupings known to produce the desired properties.

The art of dyeing is to affect materials so that the colors will not be readily removed by those influences they are likely to encounter, such as washing, rubbing, light, etc.

The use of color began with the dawn of civilization. The earliest dyes, possibly discovered by accident, may have been stains from berries, fruits and nuts used as food. Later, flowers, leaves, stems, and roots of shrubs, bark and twigs of trees were found to be sources of dyes.

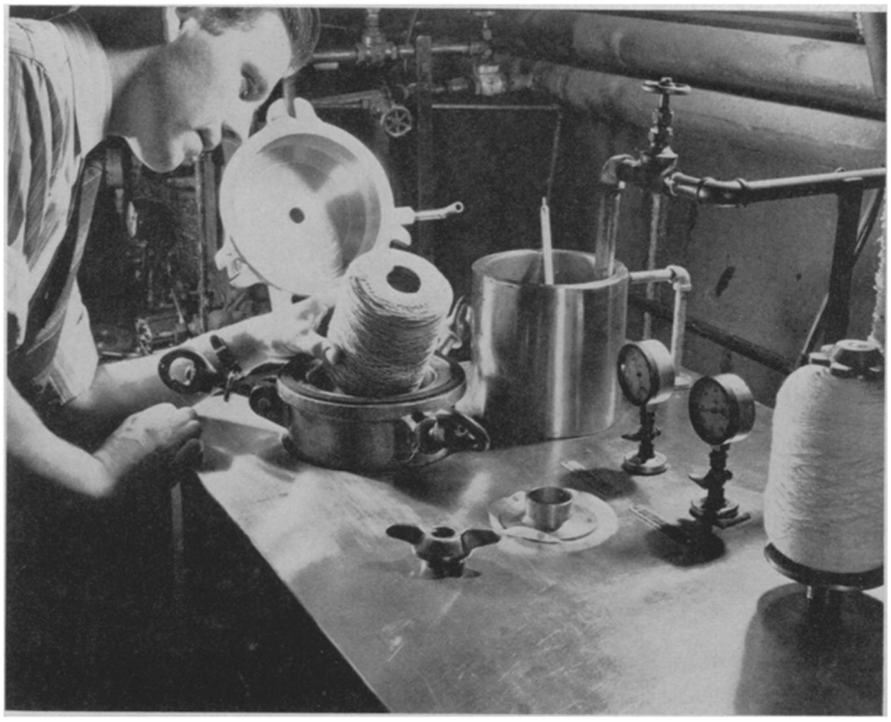
The dyeing art seems to have developed independently among primitive people of almost every country.

At first dyestuffs of vegetable origin, available in the neighborhood, were used exclusively. The dyer merely collected flowers, berries, leaves, bark or roots in nearby fields or forests and boiled them in water. Colors were limited pretty much to red, yellow, green, blue and brown; few variations in shades were possible.

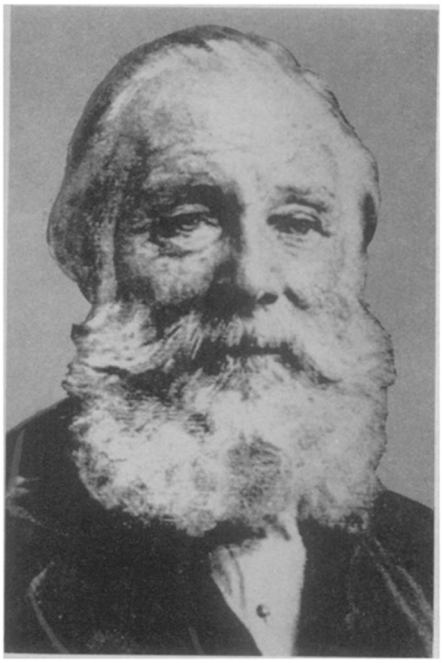
Many Sources for Dyes

Dyes have been extracted at one time or another from hundreds of different flowers, trees and shrubs, but experience showed that some sources were more satisfactory than others—sometimes because the color was more brilliant, sometimes because it lasted longer.

As dyestuffs found in one district were recognized as superior to those of another, trade began. Eventually many of the dye-



PACKAGE DYEING MACHINE—Yarn is wound around a steel coil bobbin and placed over a circular tube in a cylindrical machine, and the cover securely bolted. Dye liquor is then pumped through the perforated tube and forced out through the cone, dyeing the yarn. This illustration shows one of a series of stainless steel package dyeing machines in the Du Pont Technical Laboratory at Deepwater, N. J.



WILLIAM HENRY PERKIN—Shown in this old photograph is William Henry Perkin (1838-1907), who created the first synthetic dye, mauve, in 1856. Many years after his original discovery, honors were heaped upon him, including knighthood.

stuffs used in ancient times were discarded, so that only a few survived.

Natural dyes are seldom used today. Chemical dyes, discovered in the last century, have proved so popular there is little demand for the old time favorites such as indigo (blue), madder (red), woad (blue), logwood (purple), fustic (yellow), and tumeric (yellow).

European chemical manufacturers quickly seized the opportunities opened by Perkin's discovery of synthetic dye.

The Germans, particularly, learned from the British and built, with government support, an industry that until 1914 had a virtual monopoly on the manufacture of dyestuffs.

When foreign sources of dye were cut off from the United States during World War I, chemical manufacturers in this country began making dyes.

Today, the United States has a dye industry that is unsurpassed.

Research in dyes is continuing and new types are still being developed. At the present time, there are more than 1,000 separate dyes that include all the colors of the spectrum, with degrees of fastness capable of meeting almost every normal requirement.

The dye industry has contributed more than color. Research in dyes developed a whole array of important organic chemical products.

Explosives that increase ability to wage war arose out of research on nitrated compounds, which are close in structure to dyes.

Many photographic chemicals, perfumes, flavorings and insecticides had their start in dye chemistry.

Synthetic camphor, so important in the making of plastics and for medicinal purposes, was developed in a dye research laboratory.

The raw materials and intermediate chemicals used in dye manufacture provide a broad range of modern medicinal chemicals. Drugs of the "sulfa" family and atabrine, the anti-malarial, are notable examples.

Other new commercial products, although not directly related to dye research, are being developed as a result of engineering research and experience gained through dye production.

SCIENCE SERVICE has prepared a kit containing a sample of Perkin's mauve dye, a swatch of material dyed mauve, and an undyed swatch of material. There are also samples of four other types of dyes: acid, direct, vat and disperse. A booklet accompanying the kit describes simple experiments that can be performed with the dye samples to demonstrate their unique qualities.

These kits are available for the curious-minded at 75 cents each, or three for $1.50, from SCIENCE SERVICE, 1719 N St., N. W., Washington 6, D. C. When making a request, ask for the Dye Unit.

Science News Letter, September 8, 1956

MEDICINE

Heart Drugs Hunted In Costa Rican Plants

➤ FROM THE JUNGLES of Costa Rica there is hope that new heart drugs and new sources of old remedies can be brought to America's clinics.

Dr. Bernice G. Schubert of the U. S. Department of Agriculture's Plant Industry Station, Beltsville, Md., told the American Society of Plant Taxonomists meeting at the University of Connecticut about making 600 collections of plants during two "alkaloid-hunting" expeditions to Costa Rica this year and last.

The National Heart Institute of the U. S. Public Health Service is testing the promising plants collected and identified by Dr. Schubert.

Some of the plants collected were those used medicinally by natives and in this way recommended for scientific attention.

Science News Letter, September 8, 1956