



GENERAL DESCRIPTION AND CLASSIFICATION OF THE ARTIFICIAL DYESTUFFS: BY PROFESSOR CHARLES E. PELLEW, OF COLUMBIA UNIVERSITY: NUMBER II

THE artificial dyestuffs form such a large body of complicated chemical compounds that at first glance it would seem hopeless for any one who is not a trained organic chemist to get any clear or definite ideas about them. This, indeed, would be the case if any attempt were made to study them chemically, *i. e.*, with reference to their composition or their method of manufacture, but when it comes to the application of them to the various textile fabrics and other materials for which dyes are valuable we soon find that the problem is not so very difficult, after all.

To be sure, there are hundreds, if not thousands, of different dyes on the market now, about half of them being known under five or six different trade names, according to the particular manufacturer. But fortunately all can be separated more or less accurately into five or six different classes of dyes, each one of which is used for dyeing particular materials in a particular manner. For instance, if we should come across a dyestuff marked, let us say, "Acid Red, B, Metz," it would not be necessary to hunt up that particular color in the Metz catalogues to know how to use

it. It would be pretty safe to assume that it belonged to the class of "Acid Dyes," and hence that, like the many hundred other dyes of that class, it would be useless for cotton or linen, but could dye wool, silk and other animal fibers in a bath containing free acid.

And now about obtaining the colors. Though originally started in England, the dyestuff industry for the last thirty-five years has been centered almost exclusively in Germany. In that country there are now six or seven factories of the first class, with enormous capital, and large and very profitable output. There are several smaller factories in Germany, and both France and Switzerland have two or three houses of considerable size and importance, whose output, however, is not brought to this country as much as the German products. In England and the United States the industry is small and hardly worth our attention. All of the large manufacturers have active and splendidly organized agencies in New York, with branches in the important cities, and are most energetic and broad-minded in pushing the sale of their products, and in introducing novelties.

But here also let me put in a word of

CLASSIFICATION OF COAL TAR COLORS

warning. It is out of the question for any dyer, and especially any amateur, to keep in touch with what is being produced by each of the large houses, any one of which may have twenty or thirty new and interesting colors come out in one season. It is generally far more satisfactory to select one or two of the large houses, who cover the particular field, and then deal almost exclusively with them. Above all, the amateur should if possible avoid the retail seller of dyes—of whom there are several—putting up dyestuffs in small packages at very high prices under special fancy names. The dyes, as sold by the manufacturer, cost on an average from 50c. to 75c. a pound; and, while the purchasing of colors at this price and retailing them under assumed names for 10, 20 or even 25c. an ounce may be good business, it is more profitable to the dealer than to the amateur purchaser.

The chief disadvantage in the procedure, after all, is not the extra expense,—though, to be sure, that is an item,—but the ignorance of the true name of the dyestuff and hence the impossibility of knowing how it should be applied and what the results will be. Any one who knows anything of the subject could tell just how and what to dye with, for instance, Methyl Violet R, from any one of a dozen manufacturers. But it would be a pretty difficult matter to know just what would result from a little package of, say, "Empire State Brilliant Violet," sold, at ten times its value, over the counter of some country drug store or grocery shop.

In these articles, after discussing each class of dyestuffs and explaining their application and general properties, lists will be given of three or four selected colors from the New York agents of five of the largest and most reliable German manufacturers. Workers wishing

to obtain these dyes may do so by writing to THE CRAFTSMAN for the name and address of the agent handling the kind of dye that is required. It would be best in such cases to give a brief description of the kind of dyeing they wish to undertake and the effects they wish to produce. These agencies are willing to sell their dyestuffs as called for, in packages of one pound and upwards, and if sufficient demand shall arise, they will undoubtedly make arrangements, either through their own office or through some separate retail agents, to supply still smaller quantities, properly labeled, at prices not unreasonably high.

By the way, it is important to remember that to identify a color it is necessary to know these three points: First, the trade name; secondly, the shade or distinguishing letter; and, third, the manufacturer. The trade name may have some reference to the class, properties and color of the dye, as, for instance, Fast Acid Blue; or to its composition, as Methylene Blue or Thio-gene Brown. But in most cases it is an arbitrary name, given by the original manufacturer when the patents were issued, or assigned later by the local agents.

The letter or letters following the name refer generally to the shade, as, for instance, B for blue, R for red, G for yellow (German, *gelb*), and so on. Thus Methyl Violet is sold in brands running all the way from 6B to 6R,—that is, from full purple shades very close to blue, to bright violet shades very close to red. Sometimes the letter refers to the composition or class, as Fuchsine S (German, *sauer*), generally known as Acid Fuchsine, or Alizarine Blue, D, where the D indicates a direct cotton color. But usually it is a mark applied for purposes of identification, whose significance cannot easily be learned by those not in the business.

CLASSIFICATION OF COAL TAR COLORS

Finally comes the name of the manufacturer or agent, which is absolutely necessary, in very many cases, in order to distinguish one dye from another of the same name. The best of the older dyes, whose patents have expired, are manufactured, more or less of the same strength and shade, by all the large firms, although not always under the same names. But the later colors are, of course, the individual property of the different manufacturers, and the name alone gives, often, but little clue to the color, unless the name or initials of the maker accompany it.

But with these three essentials correctly given, name, brand and maker, a color can be identified and obtained true in composition and shade, even after the lapse of many years.

CLASSIFICATION OF THE COAL TAR COLORS

- I. *Direct Cotton Colors*—
(salt colors).
- II. *Colors Formed by Oxidation.*
 - (a) Sulphur dyes.
 - (b) Vat dyes, Indigo, etc.
- III. *Basic Dyes.*
- IV. *Acid Dyes.*
 - (a) Without after treatment.
 - (b) Developed by metallic salts.
- V. *Mordant Dyes.*
 - (a) Alizarine and its allies.
 - (b) Chrome dyes.
- VI. *Spirit Soluble Colors.*

CLASS I. DIRECT COTTON DYES.

These dyes, discovered comparatively recently, have the property of dyeing cotton, linen, paper, and other vegetable fabrics directly, that is, without the assistance of any intermediary, such as tannic acid, alum, or similar chemicals, known as mordants, and used to make the dye adhere to the fabric.

Before these colors were discovered it was a matter of some difficulty to fasten the dye to the material. Vegetable fibers consist almost entirely of

the very inert substance, cellulose, which has little or no affinity for the earlier known dyestuffs, of the basic and acid classes. These colors will dye animal fabrics, wool, silk, feathers, leather, etc., with great ease, and adhere firmly to them, but when they are boiled up with cotton or linen, under the same conditions, the dye will wash right out, unless the fibers have previously been impregnated with some mordant or fixing agent.

Since the accidental discovery, in 1885, of the peculiar affinity for cotton and other vegetable fibers of the brilliant but fugitive dyestuff, Congo Red, a vast number of colors have been introduced and have entirely revolutionized the dyeing of cotton.

Class names—The principal groups of dyestuffs belonging to this class are named as follows: Benzidine, Benzo., Chicago, Congo, Diamine, Dianil, Naphthamine, Oxamine, and Mikado.

General Applications. These colors are principally used for dyeing cotton, linen, and paper. They take particularly well on mercerized cotton, and also on artificial silk, care being taken, with the last-named material, not to heat the bath more than lukewarm. As is the case with practically every dye, they will take very readily in both wool and silk, and, indeed, often give faster and better colors on those than on cotton.

An interesting use of these dyes is the dyeing of mixed goods, *i. e.*, cotton and wool, or cotton and silk. These can be dyed evenly by these direct dyes, by dyeing in a cold or lukewarm bath, first, when the cotton will take, and then, on warming the bath, the wool or silk will take the color and come up to shade.

DYEING DIRECTIONS

For Cotton.—The color is dissolved in warm water and added to the dye-bath, which should have a moderate amount, four or five per cent. (of the weight of the goods), of soap dissolved

CLASSIFICATION OF COAL TAR COLORS

in it, and also be made slightly alkaline with soda ash. The cotton, thoroughly wetted, is then immersed, and gradually warmed, and then a considerable quantity of salt—or, better, of Glauber salt—added, and the bath brought up to a boil, and kept boiling for half to three-quarters of an hour. The goods are then taken out, rinsed slightly in water, and then dried. The reason usually given for adding salt or Glauber salt to the dyebath is that its presence makes the dyestuff less soluble in the liquid, and hence more ready to deposit on and adhere to the fiber. On account of this practice these Direct Cotton Dye-stuffs are often called the "Salt Colors."

For Mercerized Cotton.—This has such a strong affinity for the color that the amount of dyestuff and of salt may be much diminished, and the bath not heated hotter than 140° or 150° F. It is well, also, to add a little Turkey Red oil to the bath before immersing the goods.

For Linen.—Linen is dyed the same as cotton, excepting that the amount of salt is diminished, and some Turkey Red oil is added, to make the color go on more slowly, and so penetrate the fiber better.

For Wool and Silk.—These dyes are not used on animal fibers as much as the Acid Dyes. They will, however, dye wool in a hot bath containing a considerable amount of salt or Glauber salt, and slightly acidified with acetic acid. After dyeing, the silk is rinsed in water slightly acidulated with acetic acid.

Colors Produced.—These direct cotton, or salt dyes, give as a rule very bright, clear, pretty shades. They are easy of application and dye evenly.

On cotton the colors are not, as a rule, fast to light, and are apt to bleed when boiled with white goods. On wool and silk the colors, while not, in most cases, fast to light, are very fast to washing.

Selected Colors.—The dyes mentioned in the following table are all decidedly fast to light, far more so than most of the class:

Badische—Oxamine Blue B; Cotton Yellow G; Oxamine Fast Red F.

Cassella—Diamine Fast Blue FFG; Diamine Fast Yellow FF; Diamine Fast Red F; Diamine Fast Brown R; Diamine Fast Grey G.

Elberfeld—Brilliant Azurine 5G; Chryso-phenine G; Benzo Fast Scarlet 4BS.

Kalle—Direct Blue B conc (concentrated); Naphthamine Yellow NN conc; Naphthamine Fast Red H; Naphthamine Brown HR.

Metz—Direct Blue 108; Oxydianil Yellow O; Direct Scarlet B.

After Treatment.—To increase the fastness to washing and, to some extent, to light, of these dyes, it is customary to after-treat them, especially when dyed on cotton. By the process known as "Diazotizing and Developing" these can be made *exceedingly* fast. The method, however, is hardly available for any one not a skilled dyer.

It is also possible, by "topping" fabrics dyed with these colors with Basic dyes, to get shades quite fast to washing. Only a few, however, of the Basic colors, like "Methylene Blue" or "Methylene Violet," are any faster to light than the common run of the direct cotton colors themselves.

The simplest method of after-treating is to boil the dyed goods for fifteen or twenty minutes in a bath containing a little copper sulphate, 1½ or 2 per cent., and sometimes the same amount of bichromate of potash, acidified with a little acetic acid. This, in general, fixes the color so that it will not wash out nor bleed, and makes it faster to light at the same time.

This after-treatment is not necessary for wool and silk dyed with the selected colors, but, in special cases, will be found valuable for cotton.