The basic dyes as a rule are more difficult to bring into proper solution than the acid dyes, and there is more likelihood of tarry products being present in the solution. The basic dyes are quite sensitive to hard water, and unless pure soft water can be obtained for the solution, a small quantity of acetic acid should be added to the water in order to prevent the formation of any precipitate by the interaction of the dyestuff with the lime and magnesia salts.

Many of the basic dyes are partially decomposed by a prolonged boiling in water with the production of insoluble sticky residues, consequently in dissolving these dyes it is best not to boil the solution, especially by the introduction of live steam from an open pipe directly into the solution.

In this connection it may be mentioned that trouble is often experienced in the dissolving of dyestuffs by first putting the dry dyestuff into the pail to be used for the solution, then filling with water and heating up by introducing a steam pipe into the pail. Under such conditions the larger part of the dyestuff is at the bottom of the pail and comes in direct contact with the superheated live steam. This causes a great overheating of the dyestuffs, and in many cases may lead to its decomposition and destruction.

Instead of introducing live steam into the solution, it is far better to use a pail fairly well filled with hot water (in the case of acid dyes this may be practically at the boiling point, whereas with basic dyes the temperature should not be over 180 deg. Fahr.) and then sift in the required dyestuff, constantly stirring the solution with a wooden stick. Large lumps or solid aggregates of the dyestuff should not be added, but these should be broken up before going into the solution. As an ordinary sized pail usually contains from 2½ to 3 gallons of water, it is best to dissolve only about half a pound of the dyestuff in each pail of water, unless the dyestuff is especially soluble. Textile Mercury.

HISTORY OF DYEING.*

By Julius Hubner, M.Sc.Tech., F.I.C.

Every student of technology ought to be acquainted with the history of his particular branch of study. This is, however, almost entirely neglected in our educational institutions and, as a rule, we find only the scantiest historical references in our modern books on technology. In some cases such references consist merely of a repetition of statements which have been made by writers in the latter half of the 18th century, and which have passed on from one publication to another to the present day, hence the importance of this article to the textile industry.

We have definite proof that the Egyptians practised the art of dyeing during the XII dynasty, about 2500 *B. C.* The color of all the dyed mummy bandages was yellowish, and in most cases had been produced with the yellow coloring matter of the safflower. Two of the bandages had been dyed with iron buff. Other colors besides yellow were, however, dyed at this early period because, according to Glen, a garment dyed with Indigo, dating from 3000 *B. C.*, was found in Thebes.

In Exodus (about 1490 *B. C.*) we find reference to "woolen and linen thread of the finest colors," and to gold cut into wires which were worked "in the blue, and in the purple, and in the scarlet."

According to Herodotus (484-408 *B. C.*) "the Milesians imported into Tarantum their fine breed of sheep, and at the same time introduced the art of dyeing and preparing wool."

Caecilius (who died 168 *B. C.*) and Plautus (who died 184 *B. C.*) inform us that Molochinarius was one who dyed cloth of the color of the mallow, and Virgil (70-19 *B. C.*) again refers to the Milesian dyed wools as follows:

> The nymphs, around her placed, their spindles ply,
> And draw Milesian wool of glassy dye.

Pliny states that dyeing of wool was the invention of "the Lydians in Sardis," and as regards "Divers kinds of wool and clothes," referring to Egyptian wool, that "the cloth made thereof, after it is worn bare, is then died, and serveth new againe, and will weare still and last a man's life."

The following most curious statement is also made by Pliny: "I have my selfe seene the sheepes fleeces upon their backes while they be alive, died with purple, with scarlet in grain, and the violet liquor of the fish Murex: by the means of certaine barks of a foot and a halfe long dipped in these colors, and so imprinted and set upon their fleeces as if riotous wantonnes and superfluitie should force Nature's worke, and make wool to grow of that color."

Concerning the "mysterie of dying cloth," he speaks of three "tinctures . . . the one in graine which striveth with that bright orient color in Roses . . . the Scarlet or Purple of Tyros or the double died Dibapha . . . the seconde Amethyst color, and resembles the March violet . . . the third made of the purple and porcellane shell fishes . . . for of this tincture there are cloathes which encline much to the color of Tornsoll."

According to Pliny, the Greeks, before the time of Alexander the Great (336 *B. C.*) knew only a few colors. Only during his time and during the time of his successors did they improve in the dyeing of black, yellow, green, and other colors, when they also acquired the art of making these colors fast on linen.

A very remarkable statement as regards the fastness of the colors is made in Plutarch's "Life of Alexander." He found among the treasures in the palaces of the King of Persia a large quantity of purple dyed material which, although 180 years old, had retained its beautiful brilliancy. He ascribes this to the fact that the purple had been prepared with honey.

There can be no doubt that alum and a number of other compounds, especially iron salts, were used as mordants in dyeing by the ancients. Although Beckmann maintains that alum proper was unknown in Pliny's time, the following extract from this writer will show that they were acquainted with it: "for the clear alume which they name the white, is proper for to color wooll with any bright tincture; contrariwise, the blacke serveth for sad, darke, and browne colors." If the white alum mentioned here had been an iron salt, bright colors would not have been produced.

According to Macquer, "the Greeks distinguished three operations in dyeing, *i. e.*, (1) opening and di-

*A review of this lecture was given in last month's issue of Posselt's Textile Journal. We now are able to present the article in serial form. Without question it is most interesting reading matter on the origin of Dyeing Textiles.

lating of the pores, (2) the dipping into the dyeing liquor, and (3) fixing of the color by means of certain drugs (of a styptic or astringent quality)." The Romans called this fixing operation "colorem alligare," for which they used a species of fucus, to which Pliny ascribes the property of fixing the colors on wool so effectually as never to be removed.

Lime was also used by dyers in Pliny's time under the name of *Lapis Phrigius,* probably in dyeing Woad, Indigo, or Iron Buff.

In a reference to dyeing in the 4th century we find Servius commenting on a remark made by Virgil as regards the high price of Milesian fleeces: "Milesian fleeces, most valuable wools; for Miletus is a city of Asia, where the best wools are dyed," whilst Prudentius (*A. D.* 404), in a hymn to the honor of St. Romanus, informs us of the use of herbes in dyeing in the following words:

> Their hardy frames they deck
> All o'er with tesselated spots: and art
> Is added, that the threads, twice dyed with herbs,
> May sportively intwine their various hues
> And mimic forms within the yielding warp.

Apollinarius Sidonius, in describing the products of different countries, informs us that during the 5th century silk was brought from the country of the Seres to be dyed in Phœnicia:

> The Tyrian murex, twice i'th' cauldron boil'd,
> Has dyed its silken threads.

According to Bischoff, we find that dyers were highly esteemed in Persia in very early times, and that although Mahomedans, they had Christ as their patron. A very quaint old Persian tradition states that Christ was a dyer, that He was apprenticed to a dyer who instructed Him to dye fabrics of different colors: Christ placed all the materials into one vat, and the dyer, when he took them out, to his great astonishment, found that they were each dyed to the shade required.

Abgeli de la Brosse, in "Lexicon Persicum," under "tinctoria ars," states that even to-day (1641) a dyehouse is called in Persia "Christ's Workshop."

Bischoff states that no dyeing was practiced in the Occident about the 5th century.

Lewis Anthony Muratory informs us that in translating an old manuscript from an Italian monastery, he found that dyehouses existed in Italy in the 8th century, but we find it frequently stated that during the 11th century dyeing was introduced into Italy by the Crusaders, and with it new coloring matters at that time unknown in Europe.

Black dyeing must, however, have been practised in Germany during the 10th century, because Bischoff informs us that under Henry I., the Fowler, a Guild of Black Dyers, was formed.

Emperor Friedrich I. (Barbarossa), during the 12th century, destroyed Milan, from whence many dyers went to Germany.

That dyeing must have flourished during the 12th century, in and near Jerusalem, and that it was exclusively in the hands of the Jews, is amply shown in the following statements made by Benjamin of Tudela in "Early Travels in Palestine" (*A. D.*, 1163): In Jerusalem "the dyeing-house is rented by the year, and the exclusive privilege of dyeing is purchased from the king by the Jews of Jerusalem, two hundred of whom dwell in one corner of the city, under the tower of David;" further, "twelve Jews, dyers by profession, live at Bethlehem;" and about Nob, the city of the priests, he states that "the two Jews who live here are dyers." In Jaffa we are informed "one Jew only, a dyer by profession, lives here," while about Brindisi, "containing about ten Jews, who are dyers," "Corfu, containing but one Jew, a dyer, of the name of R. Joseph," and finally, in the neighborhood of Thebes there are "about two thousand Jewish inhabitants. These are the most eminent manufacturers of silks and purple cloth in all Greece."

We find that somewhat later the art of dyeing in Italy was exclusively in the hands of the Jews, who no doubt had been brought from the East.

Most elaborate regulations for dyers were in existence in Germany in very early times. Bischoff informs us that an apprentice had to serve five years before he was able to become a "master dyer," and that he had to work winter and summer from four o'clock in the morning till seven o'clock at night. The five years' apprenticeship was finally followed by a practical test, called "the masterpiece" (Meisterstück) for the "mastership." This consisted in dyeing "24 ells of white (two ells wide) linen cloth from the clear indigo vat; further 2 lbs. of woolen yarn blue from Woad and the same quantity green from Indigo."

As early as the 13th century the German dyers formed a guild.

A French "reglement" of 1383 divides the dyers into those of "the great dye" (Teinturiers en bon teint) and those of "the lesser dye" (en petit teint).

In 1418 we find a law in Germany prohibiting a merchant buying undyed cloth in one town and having it dyed in another. The cloth had to be dyed where it was bought. The dyers at this time were divided into Cloth, Woad, or Rhenish Dyers and into Black, or Bad Dyers (Schlecht Färber), and somewhat later into Woolen, or Fine Dyers, Black Dyers, and Silk Dyers. It was in the 15th century that we first find the manufacture of silk introduced into Germany, and the silk dyers possessed the privilege of not belonging to a guild; their art was considered a "free art," they did not bear the name of "masters," but that of "Gentlemen" (Herren).

In the 16th century, a distinction was made between Black Dyers and dyers of other colors thus: In 1505, Hanns Schwarzferber (Black Dyer), and in 1537, Wilhelm Aichler ein Ferber (a Dyer).

Bischoff's description of the traveling of the dyers' assistants (Wanderjahre) is most interesting reading. He shows how the dyers moved from place to place and how each master gladly gave shelter to the traveling dyer in order to obtain the latest knowledge as regards the progress which had been made in dyeing in other parts of the country. Thus, while dyeing may have been considered "a secret art," as far as the outside world was concerned, evidently there existed the true spirit of co-operation among the dyers themselves; this is more than can be said of them in later times.

According to Beckmann, a recess of the Diet in 1577 prohibited the use of Indigo instead of Woad, describing it as a pernicious, deceitful, eating and corrosive dye, "corroding devil" (Fressender Teufel), for which vitriol and other eating substances were used. This prohibition was renewed in 1594 and 1603. A further prohibition was issued in Saxony in the year 1650 by Duke Ernest the Pious.

(*To be continued.*)