

cloths, and other substances, whereby their beauty is much improved, and value enhanced.

This art depends chiefly on three things, *viz.* 1. Disposing the surface of the stuffs to receive and retain the colours; which is performed by washing them in different lyes, digesting, beating them, &c. in which human urine putrified, a sharp salt of ashes, divers soaps, and galls of animals, are of principal use; by means whereof the viscous gluten of the silk-worms naturally adhering to their threads, is washed and cleaned from them, and thus they become fitted gradually to imbibe the colours. By these also the greasy foulness adhering to wool and flax is scoured off.

2. To grind the colours, as that they may enter the body duly prepared, and preserve their brightness undiminished.

3. The third consists in having beautiful colours.

According to Sir W. Petty's account of what is done in particular trades by the art of dyeing, 1. There is a whitening of wax, and several sorts of linen and cotton cloths, by the sun, air, and reciprocal effusions of water. 2. Colouring of wood and leather, by lime, salt and liquors, as in stoves, canes, and marble leathers. 3. Colouring of paper, *viz.* the marbled paper, by distempering the colours with ox-gall, and applying them upon a stiff gummed liquor. 4. Colouring, or rather discolouring, the colours of silks, tiffanies, &c. by brimstone. 5. Colouring of several iron and copper-works into black with oil. 6. Colouring of leather into gold-colour, or rather silver-leaves into gold by varnishes, and in other cases by urine and sulphur. 7. Dyeing of marble and alabaster, with heat and coloured oils. 8. Colouring silver into the brass-colour, with brimstone or urine. 9. Colouring the barrels and locks of guns into blue and purple, with the temper of small-coal heat. 10. Colouring of glass (made of sands, flints, &c.) as also of crystals and earthen ware, with the rusts and solutions of metals. 11. The colouring of live hair, as in Poland, horse and man's hair: as also the colouring of furs. 12. Enameling and annealing. 13. Applying colours, as in the printing of books and pictures, and as in making of playing cards, being each of them performed in a different way. 14. Gilding and tinning with mercury, block-tin, sal armoniac. 15. Colouring of metals, as copper with calamy, into brass, and with zinc or spelter into a golden colour, or into a silver one with arsenic; and of iron into a resemblance of copper with Hungarian vitriol. 16. Making painters colours by preparing of earth, chalk, and slates; as in umber, ochre, cullen-earth, &c. as also out of calces of lead, as ceruse and minium; by sublimes of mercury and brimstone, as in vermilion; by tinging whole earths variously, as in verdeter, and some of the lakes; by concrete juices, or *sæculæ*, as in gambogium, indigo, pinks, sap-green, and lakes; as also by rusts, as in verdigrease, &c. 17. The applying these colours by the adhesion of ox-gall, as in the marbled paper aforesaid; or by gum-water, as by limning; or by clammy drying oils, such as the oils of lintseed, nuts, &c. 18. The watering of tabbies. 19. The colouring of wool, linen, cotton, silk, hair, feathers, horn, leather, and the threads

DYEING, the art of giving a lasting colour to silks,

threads and webs of them with woods, roots, herbs, seeds, leaves, salts, limes, lixiviums, waters, heats, fermentations, macerations, and other great variety of management: an account of all which is a short history of dyeing.

*The materials used in the art of DYEING*, are iron and steel, or what is produced from them in all true blacks, called Spanish blacks, though not in Flanders blacks, *viz.* they use copperas, steel-slings, and slippe; they also use pewter for Bow-dye scarlet, *viz.* they dissolve bars of pewter in aquafortis; litharge is also used by some, though acknowledged by few to add weight to dyed silk. Antimony is much used to the same purpose. Arsenic is used in crimson upon pretence of giving lustre, although those who pretend not to be wanting in giving lustre to their silks disown its use. Verdigrease is also used by linen-dyers in their yellow and greenish colours; though, of itself, it strikes no deeper colour than that of a pale straw. Of mineral salts used in dyeing, the chief is alum; the true use whereof seems to be in regard to the fixation of colours. The next mineral salt is saltpetre, not used by ancient dyers, and but by few of the modern: nor is it yet used but to brighten colours, by back-boiling of them, for which argol is more commonly used: lime is much used in working blue vats.

Of the animal tribes are used cochineal, urine of labouring men kept till it be stale and stinking, honey, yolks of eggs, and ox-gall; the use of the urine is to scour, and help the fermenting and heating of woad; and is used also in blue-vats instead of lime: it discharge the yellow, and therefore is used to spend weld withal.

Dyers use two sorts of water, *viz.* river and well-water; the last, which is harsh, they use in reds and other colours wanting restringency, and in dyeing materials of the flacker contextures, as in callicoe, fustian, and the several species of cotton-works; but is not good for blues, and makes yellows and greens look rusty. River-water is more fat and oily, and is therefore used in most cases, and must be had in great quantities for washing and rinsing their cloths after dyeing. Water is called by dyers white liquor; but a mixture of one part bran, and five of river-water, boiled an hour and put into leaden cisterns to settle, is what they call liquor absolutely.

Gums have been used by dyers about silk, *viz.* gum arabic, tragacanth, mastic, dragon's blood. These tend little to the tincture, any more than gum in writing-ink, which only gives it a consistence; so gum may give the silk a glossiness; and, lastly, to increase the weight.

The three peculiar ingredients for black are copperas, slings of steel, and slippe: the restringent binding materials are alder-bark, pomegranate-peels, walnut-rinds and roots, oaken-sapling bark, and saw-duft of the same, crab-tree bark, galls, and sumac.

The salts are alum, salt-petre, sal armoniac, pot-ashes, and stone-lime; among which urine may be enumerated as a liquid salt.

The liquors are well and river water, urine, aquavi-

tæ, vinegar, lemon juice, aquafortis, honey, and molasses.

Ingredients of another class are bran, wheaten-flour, yokes of eggs, leaven, cummin seed, fenugreek seed, agaric, and fenna.

The snectics, or absterfives, are fuller's earth, soap, linseed-oil, and ox-gall.

The metals and minerals are pewter, verdigrease, antimony, litharge, and arsenic.

The colourings are of three sorts, *viz.* blue, yellow, and red; of which logwood, old fustic, indigo, and madder, are the chief.

*General observations upon DYEING.*

1. All materials which of themselves do give colour are either red, yellow, or blue; so that out of them, and the primitive fundamental colour white, all that great variety which we see in dyed stuffs doth arise.

2. That few of the colouring materials, as cochineal, foot, wood-wax, woad, &c. are in their outward and first appearance of the same colour, which by the slightest distempers and solutions in the weakest menstrua, they dye upon cloth, silk, &c.

3. That many of them will not yield their colours without much grinding, steeping, boiling and fermenting, or corrosion by powerful menstrua, as redwood, weld, woad, arnotto, &c.

4. That many of them will of themselves give no colouring at all, as copperas or galls, or with much disadvantage, unless the cloth or other stuff to be dyed be as it were first covered, or incrustated with some other matter, though colourless beforehand, as madder, weld, brazil, with alum.

5. That some of them, by the help of other colourless ingredients, do strike different colours from what they would of themselves, as cochineal, brazil, &c.

6. That some colours, as madder, indigo, and woad, by reiterated tinctures, will at last become black.

7. That although green be the most frequent and the most common of natural colours, yet there is no simple ingredient now used alone to dye green with upon any material; sap-green being the nearest, which is used by country people.

8. There is no black thing in use which dyes black, enough both the coal and foot of most things burnt or scorched be of that colour, and the blacker, by how much the matter before being burnt was whiter, as in ivory black.

9. The tincture of some dyeing stuffs will fade even with lying, or with the air, or will stain with water only, but very much with urine, vinegar, &c.

10. Some of the dyeing materials are used to bind and strengthen a colour; some to brighten it; some to give lustre to the stuff; some to discharge and take off the colour, either in whole or in part; and some out of fraud, to made the material dyed, if costly, heavier.

11. That some dyeing ingredients, or drugs, by the coarseness of their bodies, make the thread of the dyed stuff seem coarser; and some, by shrinking them, smaller; and some, by smoothing them, finer.

12. Many of the same colours are dyed upon several stuffs with several materials, as red-wood is used in cloth, not in silks; arnotto in silks, not in cloth, and may be dyed at several prices.

13. That scouring and washing of stuffs to be dyed, is done with special materials, as sometimes with ox-galls, sometimes with fullers-earth, and sometimes soap; this latter being, in some cases, pernicious, where pot-ashes will stain, or alter the colour.

14. Where great quantities of stuffs are to be dyed together, or where they are to be done with any speed, and where the pieces are very long, broad, thick, or otherwise, they are to be differently handled, both in respect to the vessels and ingredients.

15. In some colours and stuffs the tingent liquor must be boiling, in other cases blood-warm, and in some it may be cold.

16. Some tingent liquors are fitted for use by long keeping, and in some the virtues wear away by the keeping.

17. Some colours or stuffs are best dyed by reiterated dippings in the same liquor, some by continuing longer, and others a lesser time therein.

18. In some cases, the matter of the vessel wherein the liquors are heated, and the tincture prepared, must be regarded, as the kettles must be pewter for Bow-dye.

19. There is little reckoning made how much liquor is used in proportion to the dyeing drugs, it being rather adjusted to the bulk of the stuffs, as the vessels are to their breadth; the quantity of dyeing drugs being proportioned both to the colour, higher or lower, and to the stuffs; as likewise the salts are to the dyeing drugs. Concerning the weight that colours give to silk, (in which it is most taken notice of, being sold by weight, and a commodity of great price) it is observed, that one pound of raw silk loseth four ounces by washing out the gums and the natural fordes; that the same scoured silk may be raised to above thirty ounces from the remaining twelve, if it be dyed black with some materials.

Of a thing very useful in dyeing, especially of black, nothing increases weight so much as galls, by which black silks are restored to as much weight as they lost by washing out their gum: nor is it counted extraordinary that blacks should gain about four or six ounces in the dyeing upon each pound. Next to the galls, old fustic increases the weight about  $1\frac{1}{2}$  in 12; madder, about one ounce; weld, half an ounce. The blue vats in deep blues of the fifth stall, give no considerable weight; neither doth logwood, cochineal, nor even copperas, where galls are not: slippe adds much to the weight, and giveth a deeper black than copperas itself, which is a good excuse for the dyers that use it.

#### DYEING of wooll and woollen manufactures.

For black in woollen manufactures, it is begun with a strong decoction of woad and indigo, that communicate a deep blue; after which the stuffs being boiled with alum and tartar, or pot-ash, are to be

maddered with common madder, then dyed black with Aleppo galls, copperas, and fumac, and finished by back-boiling in weld. Woolis for tapestry are only to be woaded, and then put in black. For scarlet, wooll and woollen manufactures are dyed with kermes and cochineal, with which may also be used agaric and arsenic. Crimson scarlet is dyed with cochineal, mastic, aquafortis, sal armoniac, sublimate, and spirit of wine. Violet scarlet, purple, amaranth, and pansy-scarlets, are given with woad, cochineal, indigo, braziletto, brazil, and orchal. Common reds are given with pure madder, without any other ingredient. Crimson reds, carnations, flame and peach-colours, are given, according to their several hues, with cochineal, mastic, without madder, or the like. Crimson-red is prepared with Roman alum, with cochineal. Orange aurora, brick-colour, and onion-peel colour, are dyed with woad and madder, mixed according to their several shades. For blues, the dark are dyed with a strong tincture of woad; the brighter with the same liquor, as it weakens in working. Dark browns, minims, and tan colours, are given with woad, weaker in decoction than for black, with alum and pot-ashes, after which they are maddered higher than black: for tan-colours, a little cochineal is added. Pearl-colours are given with galls and copperas; some are begun with walnut-tree roots, and finished with the former; though to make them more useful, they generally dip them in a weak tincture of cochineal. Greens are begun with woad, and finished with weld. Pale-yellows, lemon-colour, and sulphur colour, are given with weld alone. Olive colours of all degrees are first put in green, and taken down with foot, more or less, according to the shade that is required. Feulemoit, hair-colour, mulk, and cinnamon colour, are dyed with weld and madder. Nacaret, or bright orange, is given with weld and goats-hair boiled with pot-ashes.

DYEING of silks, is begun by boiling them in soap, &c. then scouring and washing them in water, and steeping them in cold alum-water. For crimson, they are scoured a second time, before they are put into the cochineal-vat. Red crimson is given with pure cochineal, mastic, adding galls, turmeric, arsenic, and tartar, all mixed in a copper of fair water, almost boiling: with these the silk is to be boiled an hour and a half, after which it is allowed to stand in the liquor till next day. Violet crimson is given with pure cochineal, arsenic, tartar, and galls; but the galls in less proportion than in the former: when taken out, it is washed and put in a vat of indigo. Cinnamon crimson is begun like the violet, but finished by back-boiling: if too bright, with copperas; and if dark, with a dip of indigo. Light blues are given in a bath of indigo. Sky-blues are begun with orchal, and finished with indigo. For citron colours, the silk is first alumed, then welded with indigo. Pale yellows, after aluming, are dyed in weld alone. Pale and brown aurora's, after aluming are welded strongly, then taken down with rocou and dissolved with pot-ashes. Flame-colour is begun with rocou, then alumed, and afterwards dip

ped in a vat or two of brazil. Carnation and rose colours are first alumed, then dipt in brazil. Cinnamon colour, after aluming, is dipt in brazil and braziletto. Lead colour is given with fustic, or with weld, braziletto, galls and copperas. Black silks of the coarser sort, are begun by scouring them with soap, as for other colours; after which they are washed out, wrung, and boiled an hour in old galls, where they are suffered to stand a day or two: then they are washed again with fair water, wrung, and put into another vat of new galls: afterwards washed again, and wrung, and finished in a vat of black. Fine black silks are only put once into galls of the new and fine sort, that has only boiled an hour: then the silks are washed, wrung out, and dipped thrice in black, and afterwards taken down by back-boiling with soap.

The dyeing of thread is begun by scouring it in a lye of good ashes: afterwards it is wrung, rinsed out in river water, and wrung again. A bright blue is given with braziletto and indigo: bright green is first dyed blue, then back-boiled with braziletto and verdetter, and lastly woaded. A dark green is given like the former, only darkening more before woading. Lemon and pale yellow is given with weld mixed with rocou. Orange isabella, with fustic, weld, and rocou. Red, both bright and dark, with flame-colour, &c. are given with brazil, either alone, or with a mixture of rocou. Violet, dry-rose, and amaranth, are given with brazil, taken down with indigo. Feulemort and olive colour are given with galls and copperas, taken down with weld, rocou, or fustic. Black is given with galls and copperas, taken down and finished with braziletto wood.