

DYEING.

DYEING is the art of staining or colouring yarn or cloth. It has been practised among eastern nations from time immemorial; and in the sacred writings, we read of the vestments of the high-priest being dyed purple, of linen cloths being dyed blue, purple, and scarlet, and of rams' skins being dyed red. The famous Tyrian purple is believed to have been discovered by an inhabitant of Tyre fifteen hundred years B.C.; and immediately afterwards the Tyrian purple became the badge of royalty, and cloth dyed with it commanded a princely price. The Egyptians, Greeks, and Romans practised the art of dyeing; and gradually it became more and more wide-spread as civilisation advanced, the discovery of America and other lands materially increasing the number of dye-stuffs. In earlier times, dyeing was much more extensively followed as a domestic art than it is at the present time. In the Highlands of Scotland, however, females are still in the habit of dyeing cloth *brown* by immersing it in a solution of copperas (sulphate of iron), and then treating it with a decoction of sumach, logwood, and crottel (*Parmelia omphalodes*), a lichen which covers many rocks and trees in moist situations; *black*, by immersing the cloth or yarn in an infusion of the bark of the alder-tree (*Alnus glutinosa*), along with copperas and a little sumach; *yellow*, by the common heather (*Calluna vulgaris*) and alum; *red*, by the roots of bed-straw (*Galium verum*) and alum, &c.

The Dye-stuffs (q. v.) employed in the various processes of dyeing are numerous, and when two or more are associated together, many different shades and colours are produced besides the original colour yielded by each. The dyeing materials are procured from the mineral, vegetable, and animal kingdoms, and are often very costly. The arrangements connected with dyeing operations are at times simple, whilst at other times they are complex, and require the greatest care and skill on the part of the dyer. In communicating the deep indigo blue to woollen cloth and yarn, a vat is taken, about 6 or 7 feet in diameter, and 8 to 9 feet in depth, and nearly filled with water, along with 18 to 22 lbs. of indigo, 10 to 20 lbs. of madder, 7 to 9 lbs. of bran, and generally 7 to 9 lbs. of woad. After the requisite boiling, and the addition of 7 or 8 lbs. of lime, to form an alkaline liquid in which the indigo can be held in solution, the whole is well closed over with tightly fitting wooden covers; and in a day, the putrid fermentation of the woad and bran proceeds, the result of which is to abstract the oxygen from the blue indigo, the colour of which is gradually reduced till it assumes a yellowish colour, and the solution then contains indigo white. If woollen yarn or cloth is now dipped in this liquid, it comes out of a yellow tint, from the attachment of the white indigo solution; but when exposed

to the air, the oxygen immediately begins to act upon the white indigo, combining with it, so as to form oxidised or blue indigo, and as the process of oxidation proceeds, the yarn or cloth becomes first of a greenish and then of a blue colour. If the cloth be again soaked in the yellowish solution, and subsequently exposed to the air, the depth of the blue colour may be increased step by step, till it arrives at that deep shade of blue so well known, especially in the coarser qualities of woollen cloth. In the dyeing of cotton with indigo, the vat is prepared differently. The indigo is first ground into a thin paste with water, and afterwards placed in a vat with protosulphate of iron and milk of lime. The lime (CaO) takes the sulphuric acid (SO₃) from the sulphate of iron (FeOSO₃), forming sulphate of lime (CaOSO₃), and liberating protoxide of iron (FeO), which immediately abstracts the oxygen from the blue indigo, reducing it to white indigo, and the latter dissolves in the excess of lime present in the vat, yielding a colourless solution. When cotton cloth or yarn is dipped in this, it comes out of the vat almost colourless; but on exposure to the air, the indigo becomes reoxidised, and the cloth passes to a green, and ultimately to a deep-blue shade. The cloth or yarn is then washed in water, and afterwards soaked in very-dilute sulphuric acid, to remove any oxide of iron remaining attached, and re-washed in water, when the blue colour becomes more bright and clear.

In the fixation of colour upon cloth, recourse is often had to a mordant (see CALICO-PRINTING), which acts as a middle agent, and attaches the colour to the cloth. The principal mordants are alum, cream of tartar, and salts of tin. Previous to the application of any colour, the cloth or yarn must be well cleansed from grease, oil, &c., by scouring in soda or in soap, and except where the material is to be dyed of a dark colour, the goods are also subjected to the process of bleaching. In the case of fabrics which require a smooth surface, the preliminary operation of singeing off the loose hairs is resorted to. See CALICO-PRINTING.

DYEING OF COTTON.—The following receipts for the dyeing of cotton apply to 10 lbs. weight of cotton yarn or cloth, which is found to be the smallest quantity capable of being well dyed at one time. The proportions of each ingredient may be altered, however, so as to correspond with the quantity of cloth or yarn to be operated upon.

1. *Common Black.*—Take 3 lbs. sumach, and treat with hot water; steep the goods in the hot decoction for some hours; wring out; wash for 10 minutes in lime-water, and for 30 minutes in a solution of 2 lbs. copperas. Wash the goods well in cold water, sometimes repeating the treatment with lime, and re-washing; then work the goods for 30 minutes in a warm solution of 3 lbs. of logwood, and afterwards with 2 oz. copperas; work again for 10 minutes; wash, and dry.

2. *Jet Black.*—Proceed as at 1, adding 1 lb. of fustic with the logwood; and when 3 pints of iron liquor are used instead of the 2 oz. copperas, a more brilliant black is obtained.

3. *Blue Black.*—Use the indigo blue vat, and then proceed as at 1.

4. *Brown.*—Treat the goods with a yellow dye; then work for 30 minutes in a decoction of 2 lbs. lima wood and 8 oz. logwood; lift and work with 2 oz. alum for 15 minutes; then wash, and dry.

5. *Catechu Brown.*—Immerse the goods at a boiling temperature in a decoction of catechu; then work for 30 minutes in a hot solution of 6 oz. bichromate of potash. Wash in hot water, and if the latter contain a little soap, the colour will be improved.

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6. *Chocolate or French Brown*.—Dye the goods with a spirit yellow; then treat for half an hour with a solution of 3 lbs. of logwood; raise with a little red liquor; work for 10 minutes; wash, and dry.

7. *Red*.—Make a hot solution of 3 lbs. of sumach; introduce the goods, and let stand till the liquor is cold; then wring out, and work in water containing in each gallon a gill of red spirits (prepared by adding 2 oz. of feathered tin by degrees to a mixture of three parts of hydrochloric acid, one part of nitric acid, and one of water in the cold) for 30 minutes; wring and wash well; then work the goods for 30 minutes in a lukewarm decoction of 3 lbs. of lima wood, and 1 lb. of fustic; add a gill of red spirits; work the goods longer; wash, and dry. The famous Turkey-red is imparted to the cloth by first impregnating it with an oily or fatty substance, and then subjecting it to a decoction of madder. It is one of the most durable of all colours.

8. *Yellow or Straw*.—Work the goods in a weak solution of acetate of lead; then wring out, and work in a dilute solution of bichromate of potash; wring out, and work again in the lead solution; wash, and dry.

9. *Leghorn Yellow*.—Proceed as at 8, but add a little arnotto liquor with the solution of bichromate of potash.

10. *Spirit Yellow*.—Work the goods through a weak solution of protochloride of tin for 30 minutes; then work in a solution of quercitron bark for 15 minutes; lift out, and work again in tin solution, and wash in cold water.

11. *Orange*.—Proceed as at 8, and afterwards pass through lime-water at the boiling-point, ultimately washing in cold water.

12. *Blue*.—The goods are worked in various strengths of solutions of salts of iron, such as nitrate of iron; wring out; wash in water, and then work in solution of yellow prussiate of potash; wring out, and wash in water containing a little alum. The various shades of blue may be obtained by using stronger or weaker solutions.

13. *Green*.—Dye the cloth blue; then work in red liquor (acetate of alumina); wash in water; work in decoction of fustic or bark; raise with solution of alum; wash in cold water, and dry. The darker shades of green, as olive or bottle green, are brought out by the use of sumach and logwood along with the fustic.

14. *Puce or Lilac*.—Work the cloth or yarn in red spirits (see 7), then in logwood solution at a temperature of 140° F., adding a little red spirits, red liquor, or alum; wash, and dry; or dye the cloth blue (12); then work in solution of logwood; add alum; work again; wash, and dry.

15. *Purple*.—Soak the goods in a warm decoction of sumach till cold; work for an hour in red spirits; wash; work in hot solution of logwood; then add a little red spirits, and work again; wash, and dry. The various shades of purple may be obtained by altering the strength of the chemicals; the more sumach, the browner the hue, and the more logwood, the bluer the purple becomes.

16. *Lavender or Peach*.—Work the goods for 20 minutes in spirit-plumb (a strong solution of logwood, treated with about one-sixth of its volume of a solution of tin, made by dissolving tin in six or seven parts of hydrochloric acid, one part of nitric acid, and one of water); wring out, and wash well in cold water.

17. *Safflower Lavender* is obtained by dyeing the goods a light-blue, then working in decoction of safflower, which places a pink on the top of the blue.

18. *Drab*.—Work the goods in a decoction of sumach; lift, add copperas; rework; wash in

water; then work in a mixed decoction of fustic, lima wood, and logwood; raise with a little alum; wash, and dry. Catechu is occasionally employed.

DYEING OF WOOL.—In the dyeing of woollen yarn and cloth, the various steeps are used warm, but the washings in water are done cold. Care must be taken to remove every particle of grease from the wool by washing with soda and soap, before it is subjected to the process of dyeing, else the colouring matters will not adhere. The more common and important colours are obtained as follows:

19. *Black*.—by working the cloth in a bath of camwood, then of copperas; after which wash out; then treat with decoction of logwood and copperas; or work in a bath of bichromate of potash, alum, and fustic; lift, and expose to the air; then immerse in decoction of logwood, barwood, and fustic; thereafter of copperas.

20. *Brown*.—The goods are worked in a bath of fustic, madder, peachwood, and logwood; then introduce into dilute solution of copperas: or the goods are treated with a bath of bichromate of potash, argol, and alum, washed, and then introduced into a bath of fustic, madder, peachwood, and logwood.

21. *Red*.—by working in a decoction of bichromate of potash and alum, and subsequently in a bath of peach or lima wood, with a little alum. Scarlet is obtained from cream of tartar, cochineal, sumach, and fustic.

22. *Crimson*.—from cochineal, cream of tartar, and chloride of tin. Cudbear gives a wine tint.

23. *Pink*.—Work the goods in a bath of tartar, alum, cochineal, and red spirits.

24. *Orange*.—from a bath of sumach, cochineal, fustic, tartar, and red spirits.

25. *Yellow*.—from a bath of tartar and alum; then a decoction of bark, sumach, fustic, and red spirits.

26. *Blue*.—Various shades may be obtained from immersion in salts of iron, and then in solutions of yellow prussiate of potash (see 12). Also work the wool in a bath of argol, alum, and indigo extract.

27. *Green*.—Work the goods in a bath of fustic, argol, and alum, and thereafter in a solution of indigo. The dark shades of green, such as olive, are brought out by a bath of fustic, logwood, madder, and peachwood, and afterwards of copperas.

28. *Violet*.—from cudbear, logwood, barwood, or camwood, and peachwood; as also alum. The addition of copperas brings out a puce tint.

29. *Drab*.—The manifold shades of this colour are procured from variable strengths of decoctions of madder, peachwood, logwood, fustic, associated with alum and copperas.

DYEING OF SILK.—The operations connected with the dyeing of silk are similar to those already sketched out, but a more thorough scouring of the raw material requires to be made, so as to remove all the gum and wax belonging naturally to the fibre.

30. *Black* is obtained by working the silken material in copperas (sulphate of iron), then in logwood containing some chamber liquid, and repeating the treatment with copperas and logwood till the requisite shade is procured. A little nitrate of iron tends to give a more full, deep black; and alum and white soap are also used with advantage. Acetate of copper is occasionally used.

31. *Blue Black*.—Dye a blue as at 12, and then proceed as at 30.

32. *Brown*.—Obtain an orange by immersion in a solution of annotta, then treat with copperas; and introduce into a bath of fustic, logwood, archil, and a little alum. If a more yellow tint is required, add more fustic; redness is obtained by adding peachwood, and blueness by the addition of logwood.

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33. *Reds* are obtained from peachwood and fustic, and thereafter red spirits. Annotta is used in getting up the scarlet shades, and cochineal and safflower in the more expensive red dyes. Rubies and maroons require cudbear.

34. *Pink*—from safflower, associated with sulphuric acid and cream of tartar.

35. *Orange and Yellow*—by treating the goods with more or less strong solutions of annotta, associated with alum and white soap.

36. *Blue*—from salts of iron and yellow prussiate of potash; or from solutions of sulphate of indigo, assisted with a little alum.

37. *Green*—from steeping in decoctions of fustic and sulphate of indigo, along with a little alum. The darker shades have copperas added and logwood.

38. *French and Pearl White*.—Work the silk in a lather of white soap, to which archil or cudbear has been added, to give the required shade.

39. *Drab*—from decoctions of sumach, fustic, logwood, and more or less copperas, according to the depth of shade required.

DYEING OF MIXED FABRICS.—The coloration of textile fabrics composed of more than one kind of material, generally requires two or more processes, as the plan pursued in dyeing wool is seldom capable of fixing the colour upon cotton. The customary plan followed is to immerse the fabric in the requisite baths, to dye the wool, and then to treat the partially dyed material in the manner found suitable for cotton. Occasionally, the woollen thread of the cloth is dyed of one colour, and thereafter the cotton is treated so as to acquire a different shade or colour. The producing of a coloured pattern on cloth has already been considered under **CALICO-PRINTING**.

DYER, GEORGE, an antiquary and scholar of some eminence, was born in London, March 15, 1755, and was educated first at Christ's Hospital, and afterwards at Emanuel College, Cambridge, which he entered in 1774, and where, after four years' study, he took his degree of B.A. During the next fourteen years, he was variously engaged, chiefly at Cambridge, as usher, tutor, and as minister (in the Baptist denomination), but he finally settled in London in 1792. Here he devoted himself principally to literature, and produced, among many works of less note, the *History of the University and Colleges of Cambridge* (Lond. 2 vols., 1814), and *Privileges of the University of Cambridge* (Lond. 2 vols., 1824). He also contributed largely to magazines. He died in London in 1841. D. was a man of remarkable straightforwardness and honesty of character, qualities which are everywhere discernible in his works. He was also a poet, although now forgotten, and never famous.