

**MADDER.** See **RUBIA**. It is yellow at first, but grows red and dark with age. It should be chosen of a fine saffron color, in very hard lumps, and of a strong though not disagreeable smell. The best roots are about the thickness of a goose quill, or at most of the little finger: they are semitransparent, and of a reddish color; they have a strong smell, and the bark is smooth. Madder is also cultivated in Smyrna, and some other countries of Turkey in Asia. It is more esteemed than the best Zealand madder; and experiments have shown that it is superior to any other kind as a dyeing ingredient. The fine color of these madders, however, has been attributed to their being dried in the air, and not in stoves. The root of madder impregnates water with a dull red color, and alcohol with a deep bright red. This root, when eaten by animals with their food, tinges their urine, and their bones, of a deep red. Wool, previously boiled in a solution of alum and tartar, receives from a hot decoction of madder and tartar a very durable but not a very beautiful red color. Wool would receive from madder only a perishable dye, if the coloring particles were not fixed by a base, which occasions them to combine with the stuff more intimately, and which in some measure defends them from the destructive influence of the air. For this purpose, the woollen stuffs are first boiled for two or three hours with alum and tartar, after which they are left to drain; they are then slightly wrung and put into a linen bag, and carried into a cool place, where they are suffered to remain for some days.

The quantities of alum and tartar, as well as their proportions, vary much in different manufactories. Hellot recommends five ounces of alum and one ounce of tartar to each pound of wool; if the proportion of tartar be increased to a certain degree, instead of a red, a deep and durable cinnamon color is produced, because, as we have seen, acids have a tendency to give a yellow tinge to the coloring particles of madder. Berthollet found, that, by employing one-half tartar, the color sensibly bordered more on the cinnamon than when the proportion was only one-fourth of the alum. In dyeing with madder, the bath must not be permitted to boil, because that degree of heat would dissolve the fawn-colored particles, which are less soluble than the red, and the color would be different from that which we wish to obtain. If wool be boiled for two hours with one-fourth of sulphate of iron, then washed, and afterwards put into cold water with one-fourth of madder, and then boiled for an hour, a coffee color is produced. Bergmann adds, that if the wool have not been soaked, and if it be dyed with one part of sulphate of iron, and two of madder, the brown obtained borders upon a red. Berthollet employed a solution of tin in various ways, both in the preparation and in the maddering of cloth. He used different solutions of tin, and found that the tint was always more yellow or fawn-colored, though sometimes brighter than that obtained by the common process. Mr. Gubliche describes a process for dyeing silk with madder: for one pound of silk he orders a bath of four ounces of alum, and one ounce of a solution of tin; the

liquor is to be left to settle, when it is to be decanted, and the silk carefully soaked in it, and left for twelve hours; and after this preparation it is to be immersed in a bath containing half a pound of madder softened by boiling with an infusion of galls in white wine: this bath is to be kept moderately hot for an hour, after which it is to be made to boil for two minutes. When taken from the bath, the silk is to be washed in a stream of water, and dried in the sun. Mr. Gubliche compares the color thus obtained, which is very permanent, to the Turkey red. If the galls be left out, the color is clearer. A great degree of brightness may be communicated to the first of these, by afterwards passing it through a bath of brasil wood, to which one ounce of solution of tin has been added: the color thus obtained, he says, is very beautiful and durable. The madder red of cotton is distinguished into two kinds: one is called simple madder red; the other, which is much brighter, is called Turkey or Adrianople red, because it comes from the Levant, and has seldom been equalled in brightness or durability by our artists. Galls or sumach dispose thread and cotton to receive the madder color, and the proper mordant is acetate of alumina. The nitrate and muriate of iron as a mordant produces a better effect than the sulphate and acetate of the same metal; they afford a beautiful, well saturated violet color. The Adrianople red possesses a degree of brightness, which it is difficult for us to approach by any of the processes hitherto mentioned.

Some years ago, Mr. Papillon set up a dye-house for this red at Glasgow; and in 1790 the commissioners for manufactures in Scotland paid him a premium, for communicating his process to the late professor Black, on condition of its not being divulged for a certain term of years. The time being expired, it has been made public, and is as follows:—

*Step. 1.*—For 100 lbs. of cotton, you must have 100 lbs. of Alicant barilla, 20 lbs. of pearl ashes, 100 lbs. of quicklime.

The barilla is to be mixed with soft water in a deep tub, which has a small hole near the bottom of it, stopped at first with a peg. This hole is to be covered in the inside with a cloth supported by two bricks, that the ashes may be prevented from running out at it, or stopping it up, while the lie filters through it. Under this tub must be another, to receive the lie, and pure water is to be passed repeatedly through the first tub, to form lies of different strength, which are kept separate until their strength is examined. The strongest required for use must float an egg, and is called the lie of six degrees of the French hydrometer. The weaker are afterwards brought to this strength by passing them through fresh barilla; but a certain quantity of the weak, which is of two degrees of the above hydrometer, is reserved for dissolving the oil, the gum, and the salt, which are used in subsequent parts of the process. This lie of two degrees is called the weak barilla liquor; the other the strong.

Dissolve the pearl ashes in ten pails, of four gallons each, of soft water, and the lime in fourteen pails. Let all the liquors stand till they

become quite clear, and then mix ten pails of each. Boil the cotton in this mixture five hours, then wash it in running water, and dry it.

*Step. 2. Bain bis, or gray steep.*—Take a sufficient quantity (ten pails) of the strong barilla water in a tub, and mix with it two pailfuls of sheep's dung; then pour into it two quart bottles of sulphuric acid, one pound of gum-arabic, and one pound of sal amoniac, both previously dissolved in a sufficient quantity of weak barilla water; and lastly, twenty-five pounds of olive oil, previously dissolved, or well mixed with two pails of the weak barilla water. The materials of this steep being well mixed, tread down the cotton into it until it is well soaked; let it steep twenty-four hours, then wring it hard and dry it. Steep it again twenty-four hours, and again wring and dry it. Steep it a third time twenty-four hours, after which wring and dry it; and, lastly, wash it well, and dry it.

*Step. 3. The white steep.*—This part of the process is precisely the same with the last in every particular, except that the sheep's dung is omitted in the composition of the steep.

*Step. 4. Gall steep.*—Boil twenty-five pounds of bruised galls in ten pails of river water, until four or five are boiled away; strain the liquor into a tub, and pour cold water on the galls in the strainer to wash out of them all their tincture.

As soon as the liquor is become milk-warm, dip your cotton, hank by hank, handling it carefully all the time, and let it steep twenty-four hours. Then wring it carefully and equally, and dry it well without washing.

*Step. 5. First alum steep.*—Dissolve twenty-five pounds of Roman alum in fourteen pails of warm water, without making it boil, scum the liquor well, add two pails of strong barilla water, and then let it cool until it is lukewarm. Dip your cotton, and handle it hank by hank, and let it steep twenty-four hours; wring it equally, and dry it well without washing.

*Step. 6. Second alum steep.*—This is in every particular like the last; but, after the cotton is dry, steep it six hours in the river, and then wash and dry it.

*Step. 7. Dyeing steep.*—The cotton is dyed by about ten pounds at once, for which take about two gallons and a half of bullock's blood, mix it in the copper with twenty-eight pails of milk-warm water, stir it well, add twenty-five pounds of madder, and lastly, stir all well together. Then having beforehand put the cotton on sticks, dip it into the liquor, and move and turn it constantly one hour, during which gradually increase the heat until the liquor begins to boil at the end of the hour. Then sink the cotton, and boil it gently one hour longer; and lastly, wash it and dry it.

Take out so much of the boiling liquor, that what remains may produce a milk-warm heat with the fresh water with which the copper is again filled up, and then proceed to make up a dyeing liquor, as above, for the next ten pounds of cotton.

*Step. 8. The fixing steep.*—Mix equal parts of the gray steep liquor and of the white steep liquor, taking five or six pails of each. Tread down the cotton into this mixture, and let it steep

six hours: then wring it moderately and equally and dry it without washing.

*Step. 9. Brightening steep.*—Ten pounds of white soap must be dissolved very carefully and completely in sixteen or eighteen pails of warm water: if any little bits of the soap remain undissolved, they will make spots in the cotton. Add four pails of strong barilla water, and stir it well. Sink the cotton in this liquor, keeping it down with cross sticks, and cover it up; boil it gently two hours, then wash it and dry it, and it is finished.