

### THE CHROME MORDANTING OF WOOL.

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For the proper dyeing of such colors as logwood black, alizarine red, brown or blue, Diamond Black, etc., on woolen fabrics, it is of the greatest importance that they be properly mordanted with such agents as iron, chrome and alumina, for, if not, no good results can be obtained. Of all the mordants applied to wool, by far the most important are those of chrome, and dyers and color chemists have paid very considerable attention to the methods of applying them to wool, and many methods have been devised for the purpose. It may be convenient and not without interest if we pass in review those methods which are now in use, or been proposed for the application of wool mordants to the wool fiber.

Chromium has the property of forming two distinct series of compounds, and members of both these series are in use in wool mordanting. One of these two series are the basic chromium salts like chrome alum, chromium fluoride, chromium acetate or bisulphite of chrome, which are compounds of the green basic oxide of chromium with acids; these are mostly of a green color. The other series of compounds, such as bichromate of potash and bichromate of soda, are compounds of the acid oxide of chromium, chromic acid, with basic oxides like potash and soda; they are yellow, orange, or red in color. When wool is boiled in a solution of such salts as chrome alum, fluoride of chrome, there is some slight decomposition, and oxide of chromium is deposited in the fiber where free acid, as hydrofluoric acid from the fluoride or sulphuric acid from chrome alum is found in the bath. The wool thereby acquires a greenish-gray color. When wool is boiled with solutions of bichromate of potash or of soda, decomposition also occurs, but in this case the reaction is more complex in character, and on the wool is formed a deposit of both the acid and basic oxides of chrome and the wool becomes of a yellowish or brownish olive color. Now it is found that when wools mordanted or boiled in these different ways are subsequently dyed, two different effects are obtained; for example, with logwood the wool which has been boiled with chrome alum or fluoride of chrome acquires a blue color, while that boiled with bichromate takes a black color, and as the latter result is due to the oxidation of the coloring principle, haematoxylin, of the logwood, the mordant so obtained is called an "oxidizing" mordant, while the other, not having such action, is called a "non-oxidizing" mordant. With some dyestuffs it is desirable that a "non-oxidizing" mordant should be obtained, while, with others, an "oxidizing" mordant will yield the best results. By adding to the bath of the chromium salt such bodies as oxalic acid, tartaric acid, tartar, lactic acid, sulphuric acid, the degree of decomposition of the chromium compound is altered and increased, and the wool fiber becomes more efficiently mordanted, and so fuller and deeper shades can be dyed. Now the manner in which these substances, or assistants as they are called, are used, causes the different modes of mordanting the wool.

Of the two different classes of chrome compounds, the basic series are of far less importance than the acid series, and we may conveniently begin our study of the chrome mordants with these. Perhaps, of all the chromium salts, although the youngest in regard to the time it has been in use, the fluoride is that which is most largely in use. The mordanting bath is made from 4 per cent. of the fluoride with 2 per cent. of oxalic acid, which has been found to be the best assistant for this salt of chrome. It is best to enter the wool into a lukewarm bath, then heat slowly up to the boil and work for 1 to 1½ hours at just the boil or a little below it. As a rule good and even mordanting is obtained, but it is rather dear, and does not work

well in copper kettles; further, there is a tendency for the wool to become harsh. It is only used with those dyes which do not work well with bichromates on account of the oxidizing tendencies of the latter compound. Of late years it has come much into use for the one-bath process of dyeing wool with such dyes as Diamine Fast Red F, Chrome Fast Yellow, Diamond yellow, Miradine Yellow, where the wool is dyed first in the usual way and then fluoride of chrome, usually about 3 per cent., is added to the bath to fix and develop the color.

Chrome alum is sometimes used in mordanting wool; the best assistant to use is oxalic acid, although often tartar is employed. The best proportions to use are 10 per cent. chrome alum and 2 per cent. of oxalic acid, or 3 to 4 per cent. tartar. Chrome alum is not economical to use, as it is not completely decomposed in the bath, and the whole of the oxide of chromium it contains is not deposited upon the fiber. It is fairly cheap, which is much in its favor, and it leaves the wool fiber fairly soft. It has been proposed to use oxalate of chromium as a mordant, and as this decomposes completely in the bath no assistant is necessary, but the article does not seem to have been used on the practical scale.

In the mordanting of wool there is little choice between the bichromate of potassium and bichromate of soda. The latter is the cheaper of the two; it is more soluble. On the other hand it tends to leave the wool harsher than the potash salt, and so wool-dyers prefer to use the latter, although a little dearer and not so soluble. By the use of different assistants and by regulating the duration of treatment the bichromates can be used to produce either an "oxidizing" or a "non-oxidizing" mordant on the wool, although it is obvious that it must be much easier to produce the latter than the former.

The active mordanting agent in the bichromates is chromic acid, but although that is now a commercial article, yet it does not seem, at any rate in this country, to have been used in the mordanting of wool. In the United States O. P. Amend patented its use, and this process is controlled there by the Amend Process Co. The Amend process is carried out in the following manner. A bath at about 150 deg. is prepared, and to this is added 6 per cent. acetic acid. After working the cotton in this bath for half-an-hour, 1 per cent. of chromic acid is added and the working continued for a further half-an-hour, when 6 per cent. sodium bisulphite at 70 deg. Tw. is added; at the end of half-an-hour the process is ended. By this process a "non-oxidizing" mordant is obtained, the acetic acid helps to reduce the chromic acid, while the bisulphite, owing to its strong reducing properties, completes the reduction of the chromic acid to chromic oxide, which is deposited on the fiber.

In the dyeing of logwood blacks on wool it is usual to mordant with 3 per cent. of bichromate of potash and 1 per cent. of sulphuric acid, when there is formed an oxidizing mordant upon the fiber. By the addition of sulphuric acid to the chrome bath a corresponding amount of chromic acid is set free, and this deposits partly upon the wool and is partly decomposed so that a mixed deposit of oxide of chrome and chromic acid is thrown down upon the wool. In practice it is customary to retain the mordanting bath and to add fresh material to it, and it has been observed that the mordanting action is better with old baths than with new ones, but after a time the bath changes and begins to work badly. This has been shown to be due to too much bichromate accumulating in the bath, which can be avoided by adding rather more than 1 per cent. of acid after the first bath, or rather less of bichromate. The proportions of 1 of acid to 3 of bichromate should not be exceeded, or otherwise it is found that the wool becomes harsh and over-chromed, and a good black cannot be got. Too much care cannot be taken in washing the wool after chroming so as to get rid of any excess of bichromate that may be left un-