### Magenta.

IN a previous article we have treated of the employ-ment of aniline colors in general ; we now propose to discuss one of these colors, namely, magenta or aniline red. This color is produced by the action of oxidating agents on aniline-oil. Aniline-oil is a substance simi-lar in composition to ordinary ammonia gas, with this difference, however, that one of the equivalents of hy-drogen contained in common ammonia is replaced by the organic radical, phenyl. Aniline may be produ-ced by a series of chemical processes from coal through the medium of coal-tar. These processes are in gene-ral as follows : Coal, when heated in a closed vessel, gives common coal-gas, and, in addition to this, a mix-ture of tar and ammoniacal water, which two sub-stances are readily separated by allowing them to remain undisturbed. The coal-tar, separated from all other substances, is a black, heavy, viscous fluid, com-posed of a great variety of elements. When coal-tar is heated in a retort, a quantity of different hydrocar-bons at first distills off. The various hydrocarbons dis-till in a temperature varying from 80° to 130° Centi_ grade. They consist of benzol, toluol, xylol, cumol. and cymol, and are similar to each other in composition. If the coal-tar after its separation from these hydrocarbons be further heated, it will give off several substances in succession. At first a heavy oil will be distill-ed, containing an acid substance which is known by the name of coal-creosote or phenic acid. This substance, which is often employed for disinfecting pur-poses, is extracted from the oil by treating it with an alkaline liquid—commonly with a solu-tion of soda. After several pu-rifying processes, the pure phe-nic acid is obtained as a mass of reddish white needles, which possess a very characteristic smell of creosote, and very strong acid properties. This substance being distilled off, the coal-tar gives off heavy tar-oils, which are employed for lubricating machines ; there finally remains in the retort a black substance, similar to pitch in appearance, called asphalt.

For the production of aniline only the hydro-carbons, known as benzols, are of importance. Long before these substances were employed to pro-duce aniline, chemists were aware of the fact that by treating one of these hydro-carbons with nitric acid, new compounds of very characteristic qualities were formed. Thus, by treating the benzol with nitric acid, the equivalent of hydrogen, which has combined with the radical phenyl, is removed by one equivalent of the oxygen, contained in the nitric acid ; and the subnitric acid that remains combines with the radical phenyl, and thus the hydrogen of the benzol is replac-ed by subnitric acid. The new substance thus form-ed is called nitrobenzol, and its formula is according to the deduction given above. This substance is quite different from benzol. It is a heavy yellow liquid, with the odor of bitter almonds, and was already used, previous to its employment in the manufacture of aniline, for perfuming purposes, and was known under the name of " Huile de Mirbane." Just as from the benzol we may obtain nitrobenzol, so we may obtain in turn *nitrotoluol, nitroxylol, nitrocumol,* and *nitrocymol* by simply treating the various hydro-car-bons with strong nitric acid. Reducing agents pro-duce an astonishing derangement in the above nitro-compounds. If hydrogen in the moment of its devel-opment meet with one of the above nitro-compounds, the latter will be immediately reduced ; that is to say,

the hydrogen forthwith combines with the oxygen contained in the nitro-compound, and forms water. If, for instance, nitrobenzol be treated in this manner, four equivalents of hydrogen will combine with and absorb the four equivalents of oxygen, forming four equivalents of water. But two other equivalents of the freshly produced hydrogen unite with the compound that still remains, and an entirely new substance is formed, which we may designate as an ammonia in which one equivalent of hydrogen is replaced by one of the radical phenyl. The ammonia in which one equivalent of hydrogen is replaced by one of the radical phenyl is an aniline, whose production we have thus shown. Because this ammonia contains the radical phenyl, organic chemists call it phenylamine. It is obvious that in exactly the same manner we may produce from nitrotoluol, tolylamine or toluidine; from nitroxylol, xylylamine or xylidine; and so also cumidine and cymidine The mixture of these substances, produced, as has been shown, from the benzol kinds, is called "aniline oil." It may be proper to remark here that the hydrogen necessary to form aniline from nitrobenzol is produced by pouring any acid and water on iron or zinc. By this process chemists usually procure hydrogen. From the aniline oil the coloring matters are produced, known to us by the name of "aniline colors." By means of oxidating agents, that is to say, by any substance that is able to give off oxygen, the aniline oil receives certain colors, the shades of which vary according to the quantity of the agent employed. Thus, M. Runge, who was one of the first that discovered aniline, and who, previous to all others, recognized its importance for the production of colors, obtained a blue by treating aniline with bleaching powder. Mr. Perkins obtained a violet by treating the same substance with a mixture of bichromate of potash with sulphuric acid. On a similar process is based the manufacture of magenta. We will confine our explanation to the method at present employed in its production.

A metal is employed that plays an important part in the criminal annals of the world, *arsenic.* From this metal there is easily obtained a white powder, generally known as "white arsenic," and in the language of chemists termed arsenious acid. It consists of one equivalent of metallic arsenic and three equivalents of oxygen. If this arsenious acid be treated with any substance that will supply it with oxygen, it takes two more equivalents of oxygen, so that we have a compound consisting of one equivalent of metallic arsenic and five equivalents of oxygen. This product is a white mass that strongly attracts water; it is known as arsenic acid. This acid can, of course, be reduced again to arsenious acid by separating from it two equivalents of oxygen. A solution of this arsenic acid, which oxidates rapidly through the great quantity of oxygen that it contains, is usually employed to produce the magenta from aniline. In a large iron retort the aniline oil is mixed with a convenient quantity of a strong solution of arsenic acid. The retort is then connected with a cooling worm and finally heated. A quantity of water and aniline oil is distilled off, and at about 180° Centigrade a thick brown mass is formed in the retort. The arsenic acid is partly reduced to arsenious acid, and the aniline-oil has attained a specific color. The mass thus produced is treated with boiling water, which dissolves off the arsenic forming a solution of a red color, while a black, tarry mass remains undissolved. After the red solution has been filtered, a convenient quantity of common salt is added to it, and the liquid allowed to crystallize. After several days, small crystals are formed of a greenish golden color, which, on being mixed with water, produce a red solution of great intensity. These crystals are called magenta, fuchsine, or aniline-red. They may be purified by dissolving them again in boiling water and allowing them to crystallize once more. When dried, they are then ready for the trade. These greenish golden crystals, diluted with water, give, as above stated, a brilliant

red solution, which dyes wool and silk dipped into it very rapidly in exceedingly beautiful red shades. The purifying process to which the magenta should be subjected is of great influence as regards the freshness of the color. The brown resin formed, together with the magenta, will, if not entirely separated from the latter, impart a disagreeable brown shade, and the goods dyed with this mixture will always have a dirty look. Dyers must, therefore, regard particularly the *purity* of the magenta that they buy, since fresh and brilliant colors can only be obtained from a pure pigment.

The process of dyeing with magenta is extremely simple. For animal fibres it is sufficient simply to dip them in a bath of magenta. For dyeing silk and wool the magenta crystals are dissolved in diluted acetic acid or in vinegar. The magenta might just as well be dissolved in simple water or diluted sulphuric acid as in vinegar. Practice has, however, shown that by being dissolved in acetic acid, the colors produced obtain a very agreeable bluish shade, which is very popular among the ladies. In preparing the magenta solution it is best to place the crystals together with vinegar or acetic acid in a retort, and to allow the crystals to dissolve. The retort must be placed in some warm locality, and shaken at intervals until the crystals are quite dissolved. Then the resulting thick, red fluid is obtained perfectly clean; it may be decanted or filtered and added to the bath. For the purpose of preparing the dyeing bath in a vat, water is heated by steam; when it has attained the correct temperature, as much of the above-mentioned solution is added as is sufficient to give the entire bath a perfect red hue. Into this, then, the silk or wool, after being well washed, is dipped; when wool is to be dyed the bath must be heated to boiling. We may readily observe that as the bath gradually loses its color the wool and silk attract it, and finally the entire coloring matter is fixed on the fibre. The goods are then removed from the bath, to which a fresh quantity of magenta solution is added, and the whole bath thoroughly stirred. The goods are inserted a second time, if a deeper shade be desired. In this manner every shade of red may be obtained from the brightest rose color to the darkest red. Whenever the desired shade is attained, the goods are simply removed from the bath. The main difficulty in dyeing is to prevent the coloring substance from spreading with unequal intensity over the goods. This is very liable to happen through the rapidity with which the color is attracted by the animal fibre. That portion of the fibre which is first inserted in the bath has already attracted a quantity of color before the last part of the goods has been thrown into the bath, and therefore, unless considerable caution be exercised, one part will receive a deeper shade than the other. It is advisable not to put too much color into the bath, and if the same goods are immersed several times, those goods which, on the first occasion, had been last immersed should on the second occasion be immersed first. Also by the addition of a little sulphate of soda (salt-cake) the too rapid attraction of the coloring matter may be prevented, and thus the goods will be dyed more equally. After the dyeing process has been completed, the goods are washed and dried. As we have already stated, the color produced in dyeing depends upon the quality of the magenta employed. In buying coloring matters, dyers must regard the purity rather than the cheapness of the article.

Before passing on to the dyeing of vegetable fibre, especially cotton, we desire to introduce some remarks concerning the composition and chemical nature of the magenta, not because we intend to introduce our readers into scientific speculations, but to enable them to understand the influence which mordants and other substances have on magenta. It is well known that in chemistry every substance is called a "salt" that consists of an alkaline and an acid substance whose properties neutralize each other. Such a substance is *magenta.* It contains an alkaline substance which

chemists call "rosaniline," because it is obtained from aniline and imparts a rose color. This base can combine with most acids, and produces with them a series of rosaniline salts. The salt usually employed is the hydrochlorate of rosaniline—magenta—which is obtained by the process just described. Sometimes, however, even the sulphate and acetate are sold in trade. These salts are quite as good as the hydrochlorate, but their intensity is inferior. That is to say, in order to dye a certain red shade on a certain quantity of wool, a larger quantity of the sulphate or acetate of magenta is used than of the hydrochlorate. The cause of this difference is simple enough. In rosaniline salts the constituent part which dyes is the base itself—the rosaniline. The greater the quantity of rosaniline in a salt which has this substance as its base, the better will it be adapted to dyeing purposes. Of the three salts of rosaniline that occur in trade, the sulphate, hydrochlorate, and acetate, the hydrochlorate contains the most rosaniline; hence this salt is the most advantageous for dyeing, especially as the prices of the three salts do not vary. The acetate possesses a property on account of which it is frequently preferred to the other salts. When it is employed in dyeing, the colors produced are of a very beautiful bluish shade, which is highly agreeable to the eye. It is always quite easy to transform the hydrochlorate or any other salt of this base into the acetate by the addition of a little acetate of soda to the dyeing bath. There will then result from the hydrochlorate of rosaniline, mixed with the acetate of soda, an acetate of rosaniline and common salt; the goods inserted into the resulting salt will receive a fine bluish-red shade. In a previous article on "the aniline colors in dyeing," we have mentioned the mode in which cotton is dyed with these pigments; and have spoken of the animalizing process, by which the cotton was covered with any substance derived from animals, as with albumen and caseine. The animal substance attracts the color, and thus the cotton is dyed.

Cotton when treated with oil mordant attracts aniline pigments and, therefore, necessarily magenta, it being also one of their number. As some of the rosaniline salts are not readily soluble in water, dyers prepare the cotton with any substance that is able to form one of these salts. The cotton is thus often mordanted with tannic acid, or tannin, which is contained in a decoction of gall-nut and sumac. After being treated with this decoction, the cotton may be dipped into a bath of magenta, and will be dyed. The tannic acid fixed on the fibre of the cotton forms with the rosaniline salt, dissolved in the bath, tannate of rosaniline, which is not readily soluble; this is precipitated on the fibre. The greater part of the cotton goods will in the moment of this precipitation be dyed with magenta. Magenta can also be employed for the production of mixed colors. Thus, a scarlet color may be obtained by grounding the goods with any orange color and topping with magenta. For grounding, it is, however, necessary to choose a color which is reddish-yellow, since pure yellow will not combine with the bluish-red magenta and produce a fine scarlet. For this reason annatto is employed for dyeing silk, and quercitron for wool. For purposes of printing, magenta can readily be fixed. If we desire to print on animal fibre, that is to say, silk or wool, the magenta is simply dissolved in water, to which a little acetate of soda may be added, and the solution thus obtained may be thickened with tragacanth gum or starch. This paste is then printed, and, when dry, vaporized. The vaporizing process consists in hanging the dry printed goods on sticks in a room, which is then filled with steam. The steam moistens the color and heats it, so that the animal fibre is able to fix it. After the vaporizing process is finished, the goods can be safely washed without fear of the colors fading; the gum is, of course, dissolved off off in the process of washing the goods. As vegetable fibre is unable to fix magenta, the printing of cotton is not so simple. There must be an animalizing substance employed on every spot on which the magenta

is to be fixed. The animalizing substances employed for this purpose are albumen and caseine, which have already been described in my previous paper. Albumen, prepared from eggs or from blood, is dissolved in water, until a perfectly transparent solution is obtained. This is then thickened with starch or gum, and the resulting paste is printed. The goods, after being dried, are vaporized. The vaporizing process is here employed for a purpose somewhat different from that in the case of silk or wool.

Albumen is, as is generally known, soluble in water, but at a temperature of 80° Centigrade it becomes insoluble, and therefore if it be brought in soluble form upon the fibre, and then heated to this temperature, it is fixed on the spot on which the *soluble* albumen was printed. The thickened albumen will, therefore, become insoluble on the cotton, when the latter is hung in a chamber filled with steam, because the steam has a temperature of 100° Centigrade, which is considerably higher than that necessary to coagulate the albumen. The albumen thus printed on the cotton is so perfectly fixed that water can not remove it from the fibre. If the cotton has been prepared in this manner, it will, when dipped into a solution of magenta, attract this color upon those spots only which are covered by albumen. Thus only the printed parts of the cotton are dyed. But magenta is a color of such intensity that even those parts of the cotton which were not covered with albumen are dyed by the mechanical adhesion of the color; a purifying process must, therefore, be resorted to in order to clean that portion of the cotton which was not printed. To avoid this unpleasant circumstance, magenta is usually printed upon the cotton in another way. The printing paste is composed of albumen and a thickening substance, dissolved in a solution of magenta. This paste is printed upon the cotton, which is dried and hung in a steam-chamber. The hot steam coagulates the albumen, which during this process is dyed by the magenta solution contained in the paste, so that the magenta in the paste is firmly fixed on the fibre. The cotton is then washed in order to remove the thickening substance; the magenta and albumen are fixed on the fibre. By this process it is impossible that any but the printed spots of the cotton can be dyed by the color; furthermore the tedious purifying procedure is avoided. At the same time, every other color which must be fixed by steam can be combined with the magenta and be fixed with it upon the cotton.

Sometimes the magenta is fixed by printing a paste which contains tannin and magenta; by evaporation the tannin and magenta are both fixed, and have the same qualities as were just detailed when speaking of magenta and albumen. The albumen process is, however, the one most generally employed. We will, finally, mention the caseine process, though it is but rarely employed. It consists in printing a solution of caseine, in ammonia liquor, upon the vegetable cotton fibre. After being dried the goods are inserted into an acid bath. The acid contained in this bath neutralizes the ammonia, so that the caseine is precipitated as an insoluble substance on the fibre, which can not be removed by water. The cotton, when dipped into a magenta bath, will then only dye at those spots on which caseine was printed and precipitated. The processes that we have thus named are the only ones that are known for fixing magenta on the fibre by dyeing and printing.