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 amiline red. This color is produced by the action of oxidizing agents on aniline-oil. Aniline-oil is a substance similar in composition to ordinary ammonia gas, with this difference, however, that one of the equivalents of hydrogen contained in common ammonia is replaced by the organic radical, phenyl. Aniline may be produced by a series of chemical processes from coal through the medium of coal-tar. These processes are in general as follows: Coal, when heated in a closed vessel, gives common coal-gas, and, in addition to this, a mixture of tar and ammoniacal water, which two substances are readily separated by allowing them to remain undisturbed. The coal-tar, separated from all other substances, is a black, heavy, viscous fluid composed of a great variety of elements. When coal-tar is heated in a retort, a quantity of different hydrocarbons at first distills off. The various hydrocarbons distil in a temperature varying from 80° to 120° Cent. grade. They consist of benzol, toluol, xylene, 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 distilled, containing an acid substance which is known by the name of coal-creosote or phenic acid. This substance, which is often employed for disinfecting purposes, is extracted from the oil by treating it with an alkaline liquid—commonly with a solution of soda. After several purifying processes, the pure phenic acid is obtained as a mass of reddish white needles, which possess a very characteristic smell of cresote, and very strong acid properties. This substance being distilled off, the coal-tar gives off heavy tars, which are employed for lubricating machines; these finally remain in the retort a black substance, similar to pitch in appearance, called asphalt.

For the production of aniline only the hydro-carbons, known as benzois, are of importance. Long before these substances were employed to produce 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 replaced by one equivalent of the oxygen, contained in the nitric acid; and the substitutive acid that remains combines with the radical phenyl, and thus the hydrogen of the benzol is replaced by substitutive acid. The new substance thus formed is called nitro-benzol, 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 nitro-benzol, so we may obtain in turn nitro-toluol, nitro-xylene, nitro-cumol, and nitro-cymol by simply treating the various hydro-carbons with strong nitric acid. Reducing agents produce an astonishing derangement in the above nitro-compounds. If hydrogen in the moment of its development meet with one of the above nitro-compounds, the latter will be immediately reduced; that is to say,
The hydrogen with which combines with the oxygen contained in the nitrogen compound, and forms water. If the wool could be treated in this manner, four equivalents of hydrogen would combine with and absorb the four equivalents of oxygen, forming water. But two other equivalents of the hydrogen of the freshly produced water unite with the compound that still remains, and an entirely new substance is formed, which we may designate as an amnonia. This new 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 ammonium, whose preparation we have just shown. Because this ammonia contains the radical phenyl, organic chemists call it phenammonium. It is obvious that in exactly the same manner we may produce from nitrobenzene, tolubenzene or tolaline, from nitroxylen, xylenol or xylidine. The mixture of these substances, produced, as has been shown, from the benzol, is called "aniline oil." It may be proper to remark here that the hydrogen necessary to form aniline from nitrobenzene 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 oxidizing agents, that is, by any substance which will oxidize the aniline oil to give aniline, the former contains certain colors, the shades of which vary according to the quantity of the agent employed. Thus, M. Grew, who was one of the first chemists to discover 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 mixture with a substance of bichromate of potash with sulphuric acid. On a similar process is based the manufacture of magenta. We will continue our explanation so 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 obtained by consisting of one equivalent of metallic arsenic and five equivalents of oxygen. This product is a white mass that strongly attracts water; it is called arsenious acid. This acid can be, of course, be reduced again to arsenious acid by separating from it two equivalents of oxygen. A solution of this arsenious acid, which exhibits 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 arsenious 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 mass 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 the entire arsenious solution of a 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 stand for several days, till the process has formed of a greenish, greenish color, which, on being mixed with water, produce a red solution of great intensity. These solutions are called magenta solutions or magenta colors. 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, greenish crystals, diluted with water, give, as above stated, a brilliant red solution, which dyes wool and silk dipped into it to a very rapid and brilliant red shade. 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 that which is 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 particular care in the use of the magenta that they buy, since fresh and brilliant colors can only be obtained from a pure pigment.

The process of dying 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 have a more agreeable and brilliant 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 add the acid to the crystals. The retort must be placed in some warm locality, and shaken at intervals until the crystals are dissolved. Then the resulting thick, red mass is collected perfectly clean, and may be dissolved in aniline oil or oil and added to the bath. For the purpose of preparing the dyeing bath in a vat, water is added by steam; when it has attained the desired temperature, a quarter of the above mentioned solution is added as is sufficient to give the entire bath a perfect red hue. Into this, 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 color 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 thus easily dyed to a deep beautiful red shade. 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 difficulty in dying 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 magenta solution is 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 action 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 dying 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 peculiar chemical nature of the vegetable fibres, as we are assured that it is necessary to know what every vegetable fibre is called "rosamine," because it is obtained from a root, quite different from the color. This base can combine with most acids, and produces a base of a much more resistant nature than the rosamine salts. The salt usually employed is the hydrochlorate of rosamine—magenta—which is obtained by the process just described. 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 dyen in a certain shade, a larger quantity of wood, a larger quantity of the sulphate or acetate of magenta is used than that of the hydrochlorate. The cause of this difference is simple enough. In rosamine salts the constituent part which dye is the base itself—the rosamine. The greater the quantity of rosamine in a salt which has this substance as its base, the better will it be adapted to dyeing purposes. Of the three salts of rosamine that occur in trade, the sulphate, hydrochlorate, and acetate, the hydrochlorate contains the greatest quantity of rosamine; 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 and brilliant shade, which is highly agreeable to the eye. It is always quite easy to transform the hydrochlorate or a mixed salt of this base into a more brilliant color by the addition of a little acetate of soda to the dyeing bath.

There will then result from the hydrochlorate of rosamine, mixed with the acetate of soda, an acetate of rosamine and common salt, the goods in which the latter substance will be found. The resulting salt will receive a fine bluish-red shade. In a previous article on "the aniline colors in dyeing," we have made the mode of mode in which cotton is dyed with these pigments; and have spoken of the actual dyeing process, by which the cotton was covered with some substance derived from animals, as with alluminous and casomous. The animal substance attracts the color, and forms with the cotton a kind of permanent dye).

Cotton when treated with all mordant attracts alline pigments and, therefore, necessarily magenta, it being also one of their number. As some of the rosamine 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 then converted into a material, and is called magenta. The dyeing of cotton is not so simple as that of the cotton goods will in the moment of this precipitation be dyed with magenta. Magna can also be employed for the production of mixed colored. Thus, a scarlet color may be obtained by grounding the goods with any orange color and topping with magenta. For grounding, it is necessary, however, necessarily to 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 anatois is employed for dying silk, and quassione for wool. For purposes of printing, magenta can readily be fixed. If we desire to print on animal fibre, that is, by 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 is then printed with tragnacum or starch. This paste is then printed, and, when dry, vaporized. The vaporizing process consists in boiling the dry printed goods on sticks in a retort, which is then filled with water, and 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. Of course, in this case, the magenta is washed 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 animulating sub- stance employed on every spot on which the magenta
is to be fixed. The shrinking substance employed for this purpose are albumen and casein, 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 varnished. The varnishing 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 action 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 enameled process, though it is but rarely employed. It consists in printing a solution of caustic in ammoniacal 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 caustic 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 caustic 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.