Methylene blue will serve as a type of the method by which all basic colours are compounded.

*Blue.* 2 gallons methylene blue, 10 per cent. solution in water and acetic acid.

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| **6 ,** | , thick starch paste. |
| 1 | , tragacanth mucilage. |
| 1 , | , tannic acid solution, 50 per cent. |
| 10 gallons. | |

All other basic colours are made up for printing in a similar way by replacing the blue with the required dye-stuff.

After printing, goods containing basic dyes are “ steamed,” and passed through a solution of tartar emetic, or other salt of antimony, whereby an insoluble double tannate *of* antimony and colouring matter is formed, which constitutes a much faster colour than the single tannate of the dye-stuff.

Basic colours may be printed along with “ mordant ” and albumen colours.

(c) *Application of Direct Dyeing Colours.—*These colours have a natural affinity for the cotton fibre and therefore require no mor­dant. They are not very “ fast,” however, and, though used enormously in the dyeing of plain shades, they find but little employment in printing except for the tinting of printed goods, and for the “ crepon ” style, where the colours must be able to withstand the action of caustic soda.

They are usually printed with the addition of a slightly alka­line salt (phosphate of soda) and sulphate of soda. Amongst the hundreds of direct colours equally suitable for printing mention may be made of erica for pinks; diamine sky-blue for blues; diamine violet, and diamine, chrysamine, chloramine and. dianil yellows. In fact, most of the benzidine, diamine, dianil and Congo dye-stuffs can be used for printing, but with the exception of the yellows none of them will resist the action of light and washing to anything like the extent that “ mordant ” and basic colours will. The general formula for printing these colours is as follows :—

|  |
| --- |
| 4 oz. colouring matter. |
| ; gallon water. |
| î „ starch or tragacanth thickening. |
| 4 oz. phosphate of soda. |
| 2 oz. sulphate of soda. |

After printing, with direct colours, the goods are first steamed, then slightly washed in a weak tepid soap solution and finally finished.

(d) *Application of Pigment Colours.—*Before the introduction of coal-tar colours, pigments and lakes played a much more important part in textile-printing than they do at present, though they are still largely used for certain styles of work. They form a series of colours more difficult to work than those already mentioned, but very fast to soap and light.

Pigment colours, being insoluble mineral precipitates or lakes, can only be fixed on the fibre mechanically; consequently they require to be applied in conjunction with vehicles which cause them to adhere to the fabric in much the same way that paint adheres to wood.

Of these vehicles, albumen is the most important and the best. It forms a smooth viscous solution with cold water, mixes readily with all the colours used in pigment printing, and possesses the property of coagulating when heated to the temperature of boiling water. When cloth printed with colours containing albumen is passed through hot steam or hot acid solutions, as in the indigo discharge style, the albumen coagulates, forming a tough insoluble colloidal deposit, which firmly fixes on the fibre any colour with which it is mixed.

The colours chiefly employed in pigment printing are: chrome yellow and orange, Guignet’s green or chrome green; artificial ultramarine; lamp black for greys; the various ochres for golds and browns; zinc oxide; vermilion and its substitutes, and occa­sionally lakes of the natural and artificial colouring matters. All these bodies are applied in exactly the same way and may be mixed together in any proportion to form compound shades. The amount of albumen necessary to fix them varies according to the depth of shade required (between 10 and 25 per cent. of the total weight of the made-up printing colour), and although it is usually considered in text-books as a thickening agent it is rarely used as such in practice on account of its expense. As a rule the colouring matter is beaten up into a smooth paste with the necessary quantity of a strong solution *of* albumen and then reduced to its proper strength by the addition of tragacanth mucilage or starch paste.

The main factor in the successful working of pigment colours is their fineness of division ; the finer they are the better they print and the more beautiful is their quality of colour. If they are too coarse they give rise to innumerable defects, either by sticking in the engraving or by scratching the roller, or, if they print at all, by yielding uneven masses of colour, granular and speckled in appearance and quite unsaleable. Even when finally ground they are liable to clog the engraving of the rollers—a defect which is more or less successfully overcome by replacing the colour-furnishing roller in the printing machine by a revolving brush.

The following formula of dark ultramarine blue will serve as a type of all other pigment printing colours:—

24 lb artificial ultramarine.

Place in grinding machine and beat up gradually with

4½ gallons 40 per cent. blood albumen solution.

2½ „ tragacanth mucilage, 8 oz. per gallon.

1/32 „ ammonia.

1/16 „ glycerin.

1/32 „ turpentine.

1/15 „ olive or cotton-seed oil.

Make to 8 gallons with tragacanth or water, and grind the whole until perfectly homogeneous.

The small quantities of ammonia, turpentine, glycerin and oil arc added to prevent the colour from frothing during the printing process.

Chrome yellows and oranges arc frequently mixed with a little cadmium nitrate to counteract the action of sulphuretted hydrogen on the lead salts.

The great disadvantage of pigment colours is that although extremely fast to light and soap they are liable to rub off, if the fabric is subjected to much friction in washing. They also impart considerable stiffness to the goods, and for these two reasons they are therefore restricted to the printing of small patterns, or are used for such styles as window-blinds where the stiffness is not objectionable. In very pale shades they are used for printing the grounds or "blotches" of multicolour patterns, the small quantity of albumen they then contain being insufficient to appreciably affect the softness of the cloth. In several discharge styles too —notably indigo—they find extensive use, and on the whole they constitute a most useful class of colours.

(e) *Application of Indigo.—*Indigo is printed on cloth by several different methods, the chief of which are: (1) Schlieper and Baum’s glucose process; (2) the hydrosulphite process; and (3) the pro­duction of indigo on the fibre itself by means of Kalle’s indigo salt and several other artificial preparations. The first and second processes depend upon the facts that indigo in presence of caustic alkalis may be converted into indigo-white by reducing agents, and that the indigo-white, being soluble in the alkali, penetrates into the fibres of the cloth, where it is subsequently re-oxidized to its original insoluble state.

In Schlieper and Baum’s process (also known as the glucose process) the cloth is first prepared in glucose, and then printed with a colour containing finely ground indigo, caustic soda and dextrine thickening (also made with caustic soda). After printing, the cloth is “ aged,” that is, passed through damp steam for a few minutes to effect the reduction and solution of the indigo, and is then hung up in a cool chamber for a day or two, in order to re-oxidize the indigo-white to indigo by the action of the oxygen in the air. A wash in cold water finally completes the fixation of the indigo, and the cloth may then be soaped and finished as usual. The cloth is prepared by running through a box containing a 30 per cent. solution of glucose in water; the excess is squeezed out in a mangle, and the cloth dried. It is then printed with the following colours according to shade required :—

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Dark Blue.** | **Medium Blue.** | **Light Blue.** |
| Alkaline dextrine paste | 7 ½ gal≡∙ | 8 gals. | 8 gals. |
| Caustic soda, 380 Tw. . | I „ | ∙⅛ „ | Ii » |
| Indigo 20 per cent, paste . | IÌ ,, | 2  4 »» | i „ |
|  | 10 gals. | 10 gals. | 10 gals. |

The printed goods should be dπed quickly, and “ aged ” as soon as possible to prevent the absorption of carbonic acid gas from the air, after which the operations already mentioned may be pro­ceeded with'at leisure.

The well-known blue and red pattern is produced by this pro­cess, the only difference being that, instead of white cloth, turkey red dyed cloth is used, the strong alkali dissolving out, or " dis­charging,” completely the colour from those parts of the cloth upon which it falls, and leaving the indigo as a blue pattern on a red ground.

In the *hydrosulphite process,* which is much quicker than the preceding, the reducing agent, the indigo and the alkali are all printed together on unprepared white cloth. The goods are then “ aged,” and allowed to lie a short time, after which they are washed-off in cold water first, until the indigo is thoroughly re­oxidized, and then in hot water or soap.

The hydrosulphite printing colour is as follows :—

j∙2∞ parts hydrosulphite N.F. (or 100 of the concentrated pro- I45o „ alkaline dextrine paste.

<150 ,, indigo 20 per cent, paste (ground up in gum).

1200 „ alkaline dextrine paste.

Thickening ( 150 parts dextrine or British gum.

( 850 „ caustic soda, 70° Tw.

Print, dry, 11 age " and wash off in a copious supply of cold water