

The Printing of Acetate Silk and Fabrics containing Acetate Silk

By *Gmelin and Kerth*

In recent years the dyeing of acetate silk has made considerable progress, and the printing of this artificial fibre has also met with an ever increasing interest. Owing to the peculiar behaviour of acetate silk, which differs from that of the other textile fibres, and which facilitates the production of pleasing colour combinations and striking effects, this fibre is being used for a large variety of printed styles. As the experience gathered during the last few years has enabled one to adapt the dyeing or printing method of the existing ranges of dyestuff to the peculiar properties of the acetate silk, and as entirely new groups of dyestuffs, which, when dyed or printed by special methods, possess an affinity for this fibre exclusively, it seems advisable to give a brief survey of up-to-date printing methods, both as regards fabrics of acetate silk only, as well as of mixed fabrics containing acetate silk.

A. The printing of all-acetate silk fabrics

The following particulars regarding the various printing methods refer to material which has been desized and prepared for printing.

It should be noted that during the wet treatment of fabrics containing acetate silk, both in dyeing and printing, temperatures of more than 175° F., and liquors containing fixed alkalis are to be avoided; otherwise the lustre of the acetate silk would be impaired, and saponification would be set up.

The methods used for printing calico with

basic acid, mordant, and vat dyestuffs, and with the Indigosols and Diphenyl Black, may, with slight modifications, be applied to acetate silk up to a certain point. The thickening used for acetate silk is usually composed of gum and British gum.

Basic dyestuffs are fixed on acetate silk with the aid of a tannin mordant, or by adding about 20 parts Celloxane or Mordant for acetate silk to 1000 parts of the print paste, followed by steaming, or, in the case of the tannin mordant, by a treatment with anti-mony salts.

The printing method with the aid of tannin mordant is particularly suitable for black styles produced with Printing Black VX.

Acid-dyeing wool dyestuffs. Of this class, only a few are suitable for the direct printing of acetate silk. These dyestuffs are dissolved with the aid of Glycine A or Fibril D, oxalate of ammonia is added to the print paste, and after printing, the goods are fixed by steaming for ½ hour without pressure. Steaming is followed by rinsing in cold water.

Examples of such acid dyestuffs are:

Victoria Yellow O,
Indian Yellow G, R,
Orange II, IV, RO,
Brilliant Orange ON,
Sorbine Red G,
Fixing Scarlet G, R,
Scarlet for Silk G,
Fast Red O, 3GX, AV,
Victoria Fast Violet B extra.

Most of the *mordant colors* are only suitable for fabrics of cotton + acetate silk. But some of the chrome colors, e. g.

Alizarine Yellow GG in paste,
Gallo Violet DF, DFM 27964,
Gallo Heliotrope BD,
Chrome Turquoise Blue B,
Chrome Green GD extra,
Gallo Indigo Blue S, SR, BGG,
Celestine Blue B,
Gallo Fast Green SK,
Gallo Blue E,
Gallo Grey GP,
Gallo Fast Grey B,
Gallo Navy Blue GGD, S,

may be printed on all acetate silk fabrics in the manner usual for cotton fabrics.

All these mordant colors, with the exception of Alizarine Yellow GG and Gallo Fast Green SK, give fast to soaping prints on all acetate silk fabrics even without chrome mordant. As this method produces purer effects and leaves the goods in a softer condition, it is preferred to the one for which a chrome mordant is used.

Chrome Turquoise Blue B and Chrome Green GD extra may, in place of acetate of chrome, be printed with the addition of 2% Celloxane, and give bright but not very full prints. They are printed with a gum — British gum thickening, preferably with the addition of a solvent such as Glycine A and Butanol.

Those of the *Vat dyestuffs* which may be printed by the potash or soda-Rongalite steaming process, may be used for the printing of acetate silk and acetate silk mixtures. The partial saponification of the cellulose ester is, according to the experience gained hitherto, without deleterious influence on the lustre of the acetate silk. After steaming in the Mather Platt or in the Indanthren rapid steamer, it is advisable to pass the goods at full width through a bath at 120—140° F., containing 1 part bichromate and 5 parts acetic acid 30% per 1000; this is followed by rinsing and soaping at 160—175° F.

The *Indigosols* are used for the production of prints or padded styles on acetate silk by the nitrite or bichromate process. However, satisfactory and fast to soaping prints are only obtainable provided the goods, before developing, are steamed for 5—20 minutes and provided developing is carried out at a higher temperature and for a longer period than is usual with cotton.

The solution of the Indigosol dyestuff, suit-

ably thickened with tragacanth, is printed or padded with the addition of 25—30 parts sodium nitrite and some ammonia to the print paste, the goods are then dried, steamed for a correspondingly long period and developed at 165—175° F. for 2—4 minutes in a bath containing 30 parts sulphuric acid 168° Tw. per 1000 parts liquor, together with some urca, after which they are washed and soaped at 140° F. (Patent for this process has been filed by Messrs. Durand & Huguenin S.A.).

Fine black prints may be produced on acetate silk with *Diphenyl Black Base I* by the same printing method as usual for cotton.

Of special importance for the printing of acetate silk are the special dyestuffs for this fibre, viz. the *Cellit Fast*, the *Celliton*, and the *Celliton Fast dyestuffs*.

The *Cellit Fast* dyestuffs are printed with the addition of 20—50 parts of a solvent such as Glycine A, aceto acetic ester or Butanol per 1000 parts print paste. The addition of calcium thiocyanate and Resorcine in the proportion of 40—50 parts per 1000 parts print paste will produce deeper prints.

The *Cellit Fast* dyestuffs suitable for direct printing are:

Cellit Fast Yellow GGN, R (the latter is somewhat phototrope and therefore unsuitable for mixtures),
Cellit Fast Orange G,
Cellit Fast Red B, BB,
Cellit Fast Rubine B,
Cellit Fast Violet 4R, ER,
Cellit Fast Blue A (this brand gives good results even without acetoacetic ester and calcium thiocyanate).

The *Celliton* and *Celliton Fast* dyestuffs which are particularly suitable for printing, are the following:

Celliton Fast Yellow G in paste,
Celliton Printing Yellow 3R in paste,
Celliton Red R in paste,
Celliton Fast Pink F3B in paste,
Celliton Fast Red Violet R in paste,
Celliton Fast Violet B in paste,
Celliton Blue extra in paste,
Celliton Fast Blue B in paste, BB in paste.

These dyestuffs are best printed in fine dispersion in the presence of a suitable emulsifier such as Glycine A.

After the goods have been printed with the dyestuffs referred to, they are steamed without pressure for ¼—½ hour, rinsed and, if necessary, soaped at 140° F. Some of the *Celliton* and *Celliton Fast* dyestuffs may be satis-

factorily fixed simply by a short steaming in the rapid ager.

These two groups of acetate silk dyestuffs give very bright shades, the Cellit Fast and Celliton Fast dyestuffs being also very fast to light.

For the *discharge printing* of acetate silk fabrics it is necessary to replace the Rongalite C generally used in cotton discharge printing by *Decroline soluble conc.* or *Hyraldite Z soluble conc.*, which is printed, thickened with gum, according to the depth of the desired shade, in the concentration of 150—250 parts per 1000 parts print paste. An addition of Anthraquinone and acetine in some cases improves the discharge effect. For colour discharges the basic dyestuffs, which are fast to Hydrosulphite, viz.

Rhodamine,
Auramine,
New Methylene Blue etc. but also
Gallo Navy Blue GGD and
Gallo Violet DF, DFM 27964,

may be added to the above mentioned white discharge. After printing, the goods are steamed for 5 minutes in the air-free rapid ager, then washed.

Dyeings produced with basic dyestuffs with the aid of Mordant for acetate silk or Celloxane are, with the exception of Brilliant Rhoduline Violet R, Turquoise Blue BB and Rhoduline Blue 5B hardly to be recommended for discharge grounds, as apart from the exceptions referred to, they are on exposure subsequently tinted in the discharged places. On the other hand the following acid dyestuffs:

Indian Yellow G, R,
Brilliant Orange ON,
Orange IV,
Silk Red G,
Scarlet for Silk N, G,
Fast Red AV, O and
Victoria Fast Violet B extra

may be discharged to a white with the above mentioned white discharge.

The *Cellit Fast dyestuffs* dischargeable to a white are the following:

in full shades
Cellit Fast Yellow GGN, R
Cellit Fast Red BB,
Cellit Fast Violet 4R.

in pale shades
Cellit Fast Rubine B,
Cellit Blue R.

The following brands are suitable as ground for pale colour discharges:

Cellit Fast Orange G,
Cellit Brown G,
Cellit Fast Red B,
Cellit Violet RR.

Among the *Celliton* and *Celliton Fast dyestuffs*, the following are also dischargeable to a white:

Celliton Fast Yellow paste and
Celliton Red R paste.

B. The printing of mixed fabrics containing acetate silk

1. Mixtures of cotton and Acetate Silk.

With mixed fabrics of acetate silk and real silk or some other artificial fibre, the peculiar dyeing behaviour of the acetate silk is a special feature, which may also in the production of prints be used for the creation of beautiful and novel colour effects of great variety.

As the behaviour of viscose silk is on the whole like that of cotton, the particulars given for cotton and acetate silk fibres also apply to viscose + acetate silk fabrics. After the goods have been desized with Biolase N extra powder, they are, if necessary, bleached by placing in a chloride of lime solution of 0.37° Tw., soured off with acetic acid or formic acid, then treated for 2 hours in a hydrogen peroxide bath.

In the production of direct prints on mixed fabrics of cotton or viscose silk + acetate silk, either one or the other fibre may be left undyed, or both fibres may be dyed the same shade or in different shades, by selecting suitable dyestuffs or dyestuff combinations. To this end, the goods are printed with suitable *direct dyestuffs* along with *Cellit Fast*, *Celliton* or *Celliton Fast dyestuffs*, and fixed by steaming. The direct dyestuff will be fixed on the cotton whereas the other dyestuff will be fixed on the Acetate silk only. In order to ensure pure shades, it is, however, advisable when such combinations are produced, to make a careful selection among the dyestuffs which come into question. Moreover, after steaming, the goods must be washed very carefully and, if necessary, given a light soaping for the removal of dyestuff which has not been fixed and which only adheres loosely.

Examples for print pastes:

Print Paste I

10— 40	parts	of a direct dyestuff,
10— 20	„	of a Cellit Fast dyestuff,
30	„	Glycine A,
30	„	Butanol,
390—350	„	water,
200	„	British gum powder,
300	„	gum Senegal (1 : 1),
30	„	sodium phosphate
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1000	parts	(by weight).

Print Paste II

10— 40	parts	of a direct dyestuff,
25— 50	„	of a Celliton or Celliton
		Fast dyestuff in paste,
30	„	Glycine A,
405—350	„	water,
200	„	British gum,
300	„	gum Senegal (1 : 1),
30	„	sodium phosphate
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1000	parts	(by weight).

After printing, the goods are steamed for 1 hour, then washed thoroughly, first cold, then lukewarm, if desired soaped at 85° F. with ½ part Marseille soap per 1000 parts liquor, rinsed and dried.

The following *Cellit Fast*, *Celliton* or *Celliton Fast* dyestuffs leave cotton or viscose silk unstained or practically unstained in printing:

- Cellit Fast Yellow GGN, R,
- Cellit Fast Orange G,
- Cellit Fast Red B,
- Cellit Fast Rubine B (tints slightly),
- Cellit Fast Blue A,
- Celliton Fast Yellow G paste,
- Celliton Printing Yellow 3R paste (tints slightly),
- Celliton Red R paste (tints slightly),
- Celliton Fast Pink F3B paste,
- Celliton Fast Red Violet R paste,
- Celliton Fast Violet B paste,
- Celliton Fast Blue B paste, BB paste.

The number of direct dyestuffs which leave acetate silk unstained or practically unstained in printing and which dye the cotton or viscose silk, is a very large one. The following list contains a selection of these, those which are dischargeable with Rongalite being marked with an *):

Yellow:

- Sirius Yellow *R extra, 5G,
- Dianil Yellow *RR, GC,
- Chrysohenine G.

Orange:

- Sirius Orange G,
- *Benzo Fast Orange WS,
- *Dianil Fast Orange O,
- Pyramine Brilliant Orange 3RS.

Red:

- *Sirius Red 4B,
- *Sirius Rubine B,
- Sirius Pink BB, *G,
- *Sirius Red Violet R, B,
- Sirius Scarlet B,
- *Diamine Fast Scarlet 8BSE,
- *Diamine Fast Rose G, B,
- *Dianil Light Red 12BW.

Violet:

- Sirius Violet *3B, BL,
- *Diamine Fast Red Violet FR,
- *Benzo Violet RL extra,
- *Dianil Violet AR.

Blue:

- *Sirius Blue 6G, G, BRR, BR, B,
- *Benzo Fast Blue GGL, R,
- *Benzo Fast Blue FFG,
- *Chicago Blue 6B,
- *Diamine Blue 3B,
- *Benzo New Blue 5B,
- *Diamine Black BH.

Green:

- Dianil Green AG.

Brown:

- Sirius Brown R,
- Dianil Brown AR,
- *Pegu Brown G.

Grey and Black:

- *Sirius Grey G, R,
- Dianil Black A2B,
- *Cotton Black A4G,
- *Diazanil Black AV.

In place of the direct dyeing dyestuffs, several of the Chrome dyestuffs, e. g.

- Alizarine Yellow CY,
- Chrome Yellow DF extra,
- Azol Printing Orange R,
- Chrome Fast Orange RD,
- Azol Printing Red BB extra,
- Chrome Fast Red BD,
- Chrome Red Brown 5RD,
- Azol Printing Violet RR extra,
- Chrome Brilliant Violet BD,
- Alizarine Viridine FF,
- Naphthomelane SB,

may be printed on fabrics of cotton + acetate silk in combination with Cellit or

*) The „Sirius“ colours are sold in the USA and Canada under the designation „Fastusol“.

Celliton dyestuffs, the mordant dyestuffs being fixed on the cotton and staining the acetate silk but slightly.

The peculiar behaviour of the Indigosols in relation to acetate silk permits the use of these dyestuffs, so highly valued on account of their fastness, for the production of the most varied effects on fabrics of cotton or viscose silk + acetate silk. For instance, if the goods are printed or padded with an Indigosol dyestuff, according to the nitrite process described above for all-acetate silk fabrics, both fibres are dyed approximately the same shade. On the other hand, if the fabric, printed or padded by the nitrite process, without previous steaming, is developed for 15—30 seconds at 75—85° F. in a sulphuric acid bath, then well washed and soaped at 140—160° F., only the cotton or viscose silk is dyed, the acetate silk remaining white. If it is desired to stain the acetate silk only and to leave the cotton or viscose silk white, the fabric is printed or padded with the Indigosol without the addition of nitrite to the print or padding paste, steamed for about 15 minutes after drying, well washed and soaped and subsequently developed for 1—2 minutes at 160—165° F. in a bichrome bath containing 5 parts bichrome and 20 parts sulphuric acid at 168° Tw. per 1000 parts liquor.

Developing may in place of the chrome bath be carried out for ½ minute at 120° F. in the nitrite bath containing 10 parts sodium nitrite and 5 parts sulphuric acid per 1000. The soaping preceding developing will remove the Indigosol from the cotton or viscose silk but not from the acetate silk. If the second and third processes are combined, both kinds of fibres may, of course, be dyed in different shades, and by padding twice with suitable Indigosols, fine shot effects may be obtained on fabrics of cotton or viscose silk + acetate silk. (Patent for this process has been filed by Messrs. Durand & Huguenin S. A.)

Indigosol Green IB, owing to its pronounced affinity for the cellulose fibre cannot be used for this purpose as it is not removed sufficiently from the cotton or viscose fibre by soaping.

In *discharge printing*, the discharge recipe recommended for discharge prints on all-acetate silk fabrics, for which Decroline soluble conc. or Hyraldite soluble coc. is used, is also employed in order to ensure uniform discharges on mixed fabrics dyed in solid

shades with dischargeable direct dyeing and Cellit or Celliton dyestuffs. Particulars of the dischargeable Cellit and Celliton dyestuffs will be found on page 113. Colour discharges are produced by adding discharge-resisting basic dyestuffs to the discharge paste, the basic dyestuffs being advantageously fixed by means of the usual preparation, viz. Katanol O or W, instead of adding tannic acid to the print paste; this preparation may either be carried out simultaneously with the dyeing process or by subsequent immersion in a Katanol solution.

On dyeings of mixed fabrics with dyestuffs which are partly dischargeable and partly discharge-resisting, multicoloured discharge effects are obtained on both fibres by printing with the Decroline discharge.

In the case of solid shades for which discharge-resisting dyestuffs were employed to dye the acetate silk, e. g.

Celliton Fast Pink F3B,
Celliton Fast Violet B,
Celliton Blue extra,
Celliton Fast Blue B and BB,

only the cotton will be discharged when printed with an ordinary Rongalite C discharge, whereas the acetate silk remains coloured.

2. *Mixed fabrics of wool + acetate silk.*

The desized goods are bleached with hydrogen peroxide as usual with wool-goods to be printed, given an acid chemicking, care being taken to avoid too severe chemicking.

For two-colour effects in direct printing, those of the acid dyeing wool dyestuffs are used which leave the silk particularly clean, either alone or in combination with Celliton or Celliton Fast dyestuffs, according to whether the acetate silk is desired as white or as colour effect.

The Celliton dyestuffs suitable for the printing of mixed fabrics of wool + acetate silk, although they stain the wool more or less but still within the permissible limits, are the following:

Celliton Fast Yellow RR paste,
Celliton Fast Pink F3B paste,
Celliton Red R paste,
Celliton Fast Violet B paste,
Celliton Fast Blue B paste.

The combination of the acid wool dyestuff and the Celliton or Celliton Fast dyestuff is printed, adding Glyecine A and oxalate of ammonia to the print paste. The goods are

steamed for 1 hour, thoroughly washed, first cold, then lukewarm, then soaped, as may be necessary.

The following is a selection of acid dyeing wool colours, which, in printing, leave the acetate silk white:

Yellow:

Flavazine S,
Supramine Yellow R,
Tartrazine O.

Orange:

Fast Light Orange G,
Orange GG.

Red:

Acid Anthracene Red 5BL,
Brilliant Scarlet 6R,
Supramine Red GG,
Palatine Scarlet 3R,
Amido Naphthol Red BB.

Violet:

Acid Violet 4RN,
Alizarine Direct Violet EBB.

Blue:

Cyanine B,
Alizarine Direct Cyanine 3GE,
Sulphon Cyanine brands,
Azo Wool Blue SE.

Green:

Alizarine Direct Green 5G,
Alizarine Cyanine Green G extra,
Wool Green S,
Light Green SF yellowish.

Brown:

Sulphon Acid Brown RR, 4R.

Grey:

Acid Alizarine Grey G,
Palatine Black MM.

Discharge prints on mixed fabrics of wool and acetate silk can be produced in a man-

ner similar to that usual with other mixed fabrics, along with Decroline sol. conc., but they are of minor interest.

3. Mixed fabrics of real silk + acetate silk or real silk + viscose + acetate silk.

Such fabrics are cleansed, before printing, by being taken through a warm soap bath (120° F) containing 3 parts Marseille soap and 1—2 parts ammonia per 1000 parts liquor.

The printing methods are very similar to those described for wool and acetate silk. For two-colour effects, combinations of suitable Celliton or Celliton Fast colours with such acid or direct dyestuffs as leave the acetate silk practically unstained, are used. Should a three-colour effect be desired in the presence of viscose silk, a selection is made from those direct dyeing dyestuffs which, in addition to the acetate silk, also leave the real silk unstained as far as possible, and from those acid dyeing dyestuffs which stain both the acetate silk and the viscose silk as little as possible, besides of course the Celliton dyestuffs.

Of the Celliton Fast colours, Celliton Fast Yellow G, Celliton Printing Yellow 3R, Celliton Red R, Celliton Blue extra, and Celliton Fast Blue BB stain real silk fairly strongly, Celliton Fast Yellow RR, Celliton Fast Pink F3B, Celliton Fast Red Violet R, Celliton Fast Violet B, and Celliton Fast Blue B only slightly.

The dyestuff combination consisting of acid or direct dyeing dyestuffs and Celliton or Celliton Fast dyestuffs is printed along with Glycine A, some ammonia and alum or, in the presence of direct dyeing dyestuffs along with sodium phosphate, steamed for 1 hour with moist steam, then washed thoroughly, first cold, and then lukewarm.