

# Dyeing methods for wool

## Contemporary wool dyeing and finishing

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# Summary

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1. Application procedures for different dye classes on wool
2. Dyeing wool with 1:2 premetallised dyes
3. Dyeing wool with reactive dyes
4. Dyeing wool with chrome dyes
5. Dyeing wool with 1:1 metal complex dyes
6. Dyeing wool with acid dyes
7. Stripping dyes from wool
8. Multicolour effects on wool
9. Preserving the quality of wool

# 1. Application procedures for different dye classes on wool

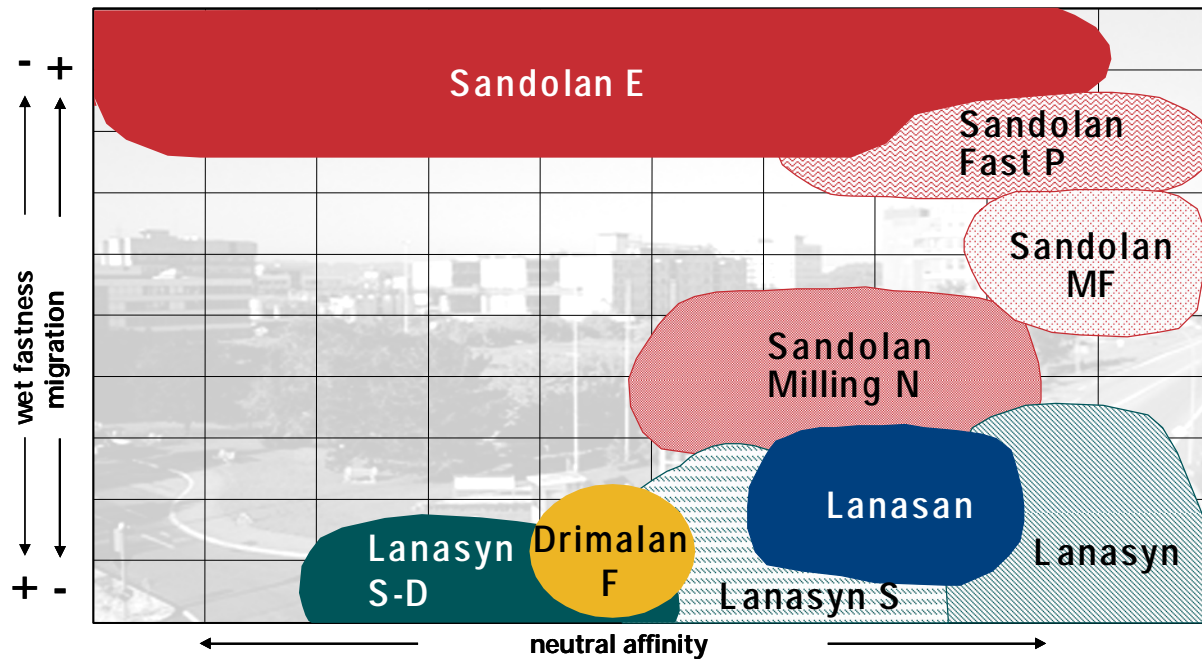
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# Dyeing of wool

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<u>General Information:</u>	P.1		
<u>Acid dyes:</u>		<u>Wool fast dyes:</u>	
- Sandolan E	P.2	- Lanasan	P.20
- Sandolan P / Fast P	P.5	<u>Reactive dyes:</u>	
- Sandolan MF	P.8	- Drimalan F	P.24
- Sandolan N / Milling N	P.12	<u>Dyes for PES / wool blends:</u>	
<u>Metal complex dyes:</u>		- Forosyn SE	P.28
- Lanasyn / Lanasyn S	P.16	<u>Dyeing chemicals:</u>	P.31

# Dyeing of wool



# Dyeing of wool

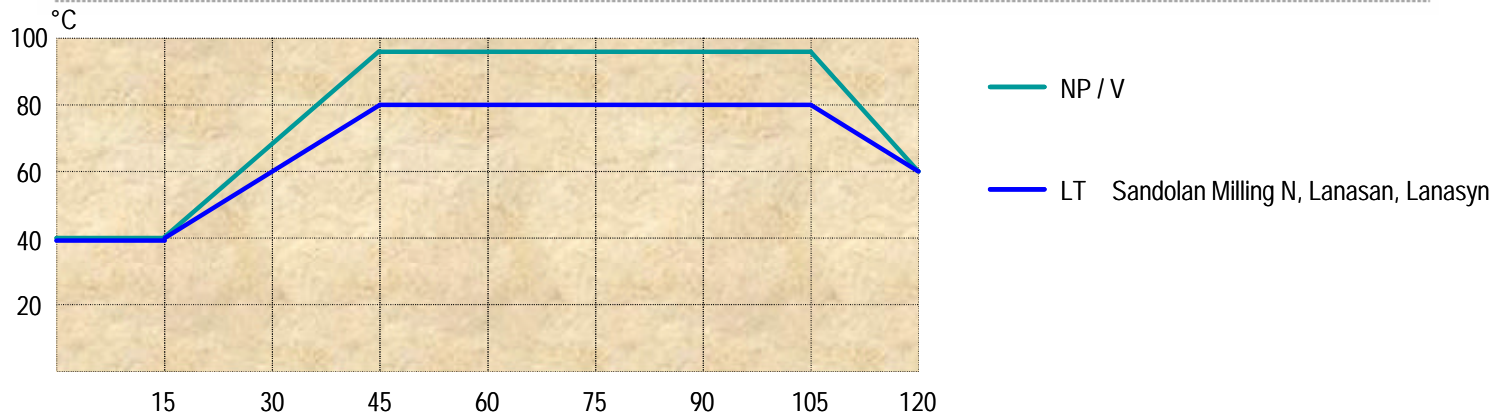
## Field of application

		Sandolan			Sandolan Milling N	Drimalan F
		E	P	MF	Lanasyn Lanasan	
<b>Wool Bleaching in the dyebath</b> Lanalbin B Powder	n					
<b>Leveling</b> Lyogen MF liq. Lyogen ULN liq. Lyogen PAM liq. Lyogen FN liq.	c am a/n am				 	 
<b>Low temperature</b> Lanasan LT liq.	n					
<b>Acid donor</b> Sandacid V liq. Sandacid VS liq conc.				 	 	 
<b>Woolprotection</b> Lanasan PW liq.	n					
<b>Improvement of wetfastness</b> Lanasan FW liq. Sandofix WES pdr.	c c				 	 
<b>Antifoam</b> Antimussol SF liq. Antimussol HT2S liq.	n n	 	 	 	 	 
<b>Anticrease</b> Imacol S liq. (synthetic) Imacol C liq. (cellulose)	n/c n	 	 	 	 	 

= main use  
 = special use

n = nonionic  
 a = anionic  
 c = cationic  
 am = amphoteric

# Dyeing of wool - dyeing procedure



Chemicals	Sandolan E		Sandolan Fast P			Sandolan MF			S.Milling N, Lanasan, Lanasy			Drimalan F		
	NP	LT	NP	LT	V	NP	LT	V	NP	LT	V	NP	LT	V
Sulfuric Acid conc %	3	3												
Acetic Acid pH			4.5	4.5		4.5	4.5		5	5		5 - 4	5 - 4	
Sodium Acetate g/l			1	1		1	1		1	1		1	1	
Glaubersalt %	10	10	10	10	10	5	5	5				10 - 0	10 - 0	10 - 0
Lyogen MF Liq. %						1	0.5	1						
Lyogen PAM Liq. %									1	0.5	1			
Lyogen FN Liq. %												1 - 1.5	1	1 - 1.5
Lanasan LT Liq. %		2		2			2			2			2	
Sandacid V Liq g/l					2			2			2			2

NP = Normal process

LT = Low temperature dyeing, wool protecting, saves energy

V = pH Shifting for difficult to penetrate articles

## 2. Dyeing wool with 1:2 premetallised dyes

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# Dyeing wool with 1:2 premetallised dyes

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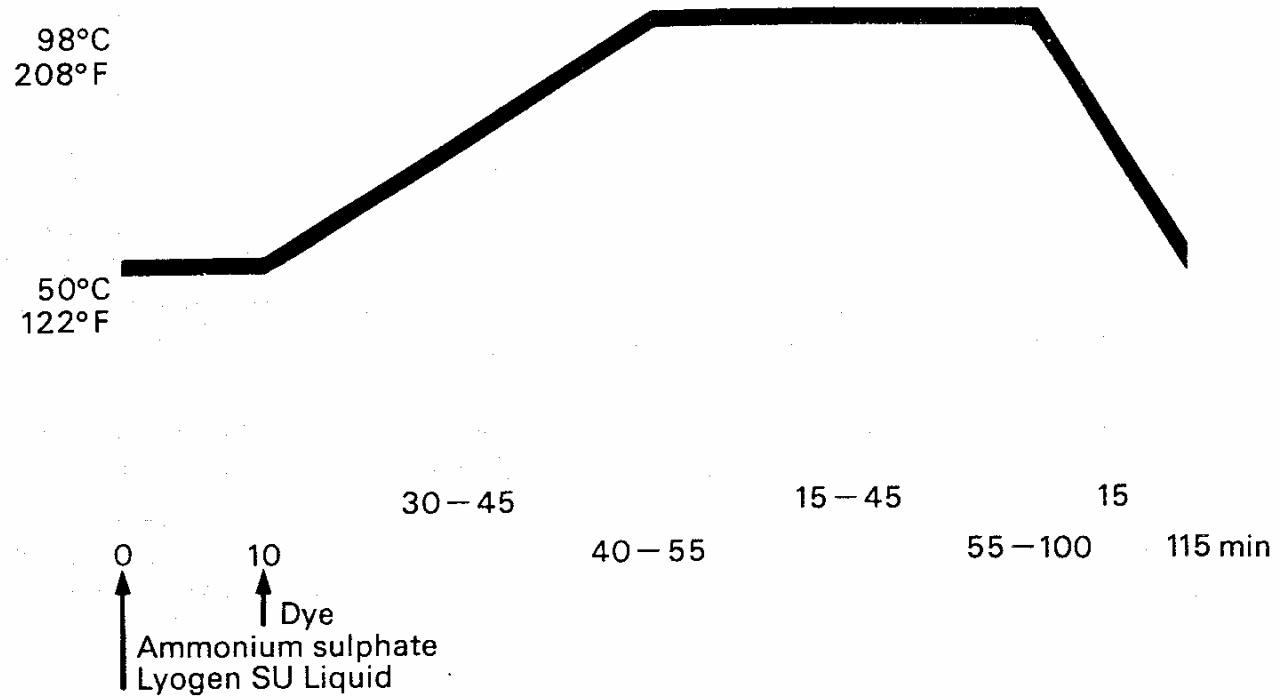
- All dye manufacturers offer 1:2 premetallised dye ranges and generally they have similar characteristics such as good fastness properties.
- They are useful for dyeing wool, silk and polyamide fibres as well as their component in blends with other fibres.

# Lanasyn S dyes

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- This is a range of sulphonated 1:2 premetallised dyes. These dyes are applied from a neutral to weakly acid bath (pH 5-7).
- They are normally dyed using anionic or amphoteric levelling agents on yarn or piece goods.

# Dyeing method for Lanasyne S dyes



### 3. Dyeing wool with reactive dyes

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# Dyeing wool with reactive dyes

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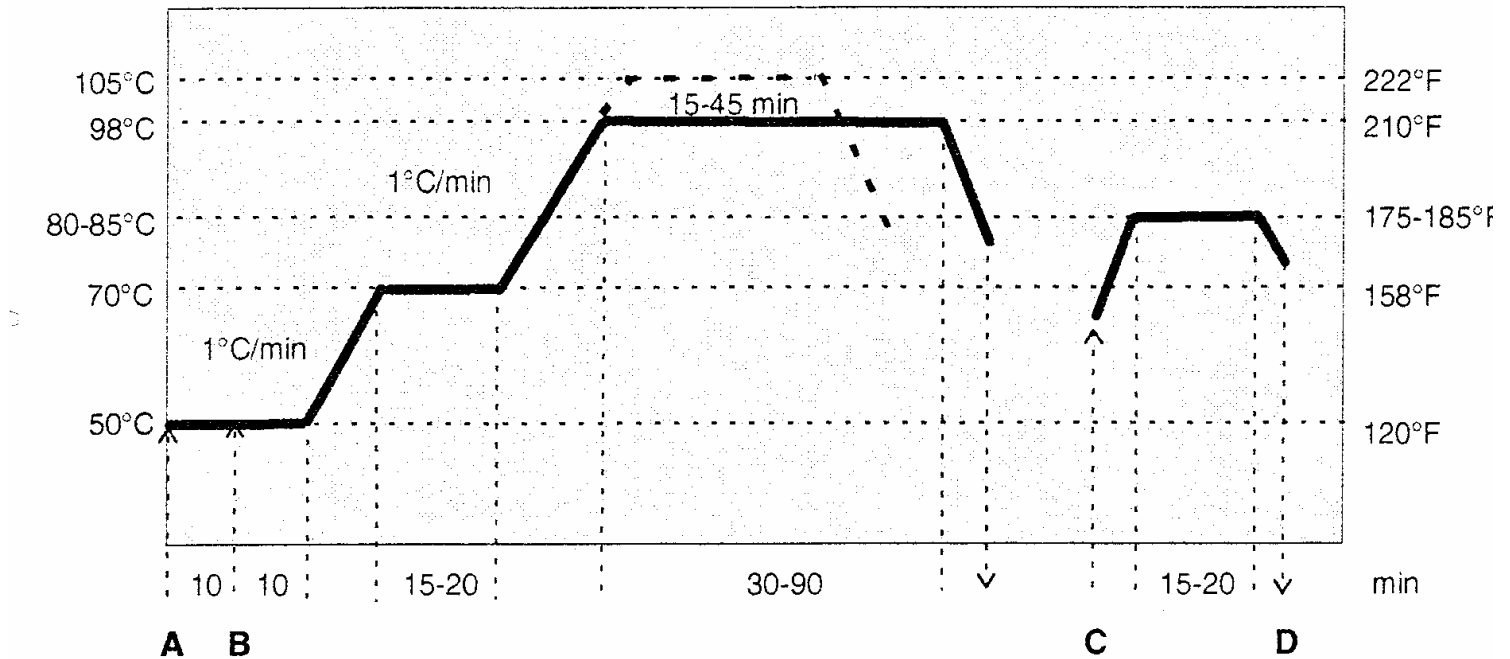
- Reactive dyes for wool are offered by a number of suppliers including Drimalan F dyes from Clariant, the Hostalan range from Hoechst and the Lanasol range from Ciba. These reactive dyes are especially suitable for dyeing machine washable wool.

## Lanasol reactive dyes

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- The Lanasol range consists of sulpho-group-containing reactive dyes which have been especially developed for wool dyeing.
- They contain one or two bromo-acrylamide reactive groups which form covalent bonds with the nucleophilic groups of the wool's amino acids during the dyeing process, resulting in outstanding wet fastness properties.

# Procedure for yarn and piece dyeing



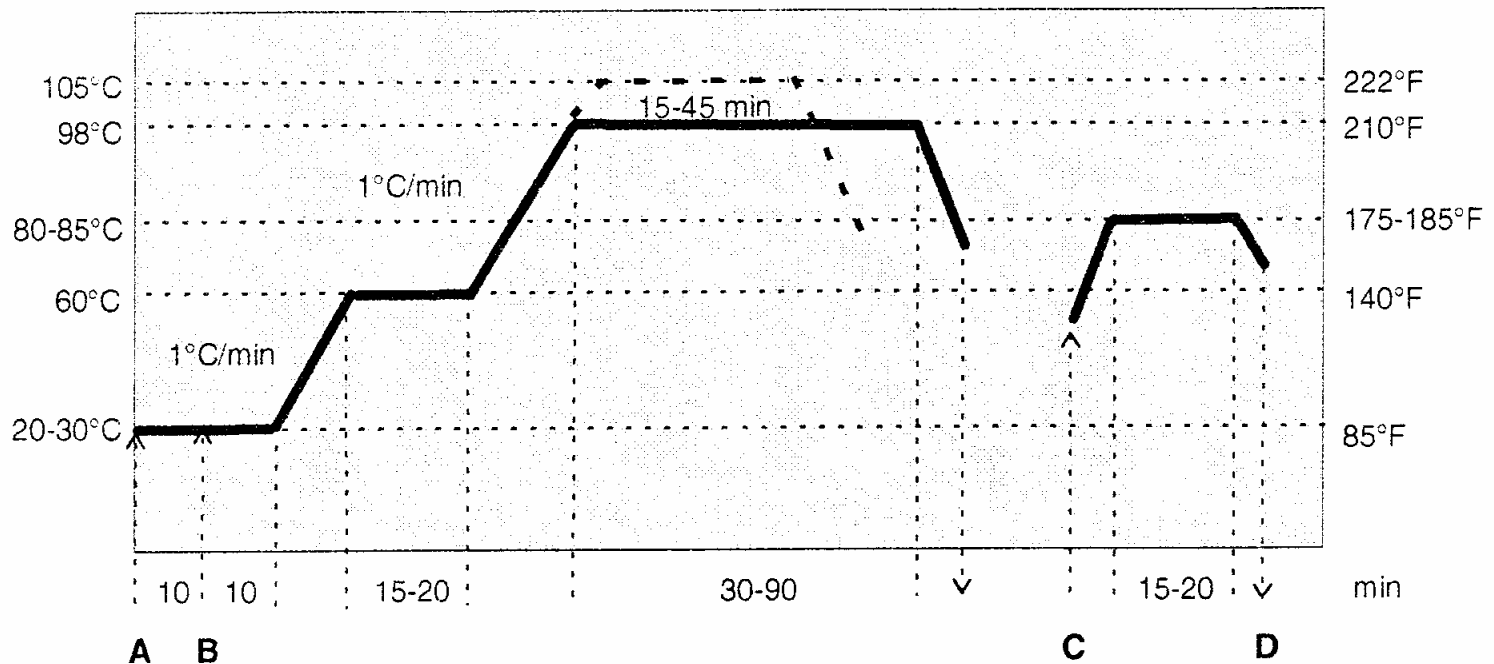
# Dyeing auxiliaries

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- A.**      0.5 g/l      Cibaflow CIR or Albegal FFA  
          1 g/l        Miralan Q  
          10-5%     Glauber's salt anhyd.  
          1 -2%      Albegal B  
          4%        ammonium sulphate  
          x%        acetic acid 80%  
          pH 7.0 - 4.5 (see pH curve)
- B.**      y %      Lanazol dyes
- C.**      Preferably in a fresh bath at 80-85°C  
          z % ammonia or soda ash or sodium bicarbonate  
          pH 8.0 - 8.5
- D.**      Rinse warm and cold  
          Acidify with 1 % formic acid 80% in the final rinsing bath



# Procedure for shrink resist-treated and machine washable wool



# Dyeing of wool with reactive dyes

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## Drimalan F

### Ideal dyestuff range:

- yarn dyeing
- garment and knitwear
- dyeing loose stock and tops
- dark and brilliant shades.

### Arguments for this dyestuff range:

- brilliant shades
- high wet fastness properties
- fast dyeing on Hercosett wool.

# Dyeing of wool with reactive dyes

## Drimalan F / Drimarene K

### Trichromatic elements

1/1 SD



Drimalan Golden Yellow F-3RL **RY 125**



Drimalan Brilliant Red F-B **RR 147**



Drimalan Blue F-GRL **RBL 209**

### Further elements

- ↓ Drimaren Yellow K-4G CDG **RY 39** Shade
- ↓ Drimaren Scarlet K-3G CDG **RR 136** Shade
- ↓ Drimalan Blue F-B **RBL 114** Shade
- ↓ Drimalan Turquoise Blue G 150 **RBL 224** Shade
- ↓ Drimalan Navy F-R\* **Mix** Build up
- ↓ Drimalan Black F-2R\* **Mix** Build up

(\*Clariant UK)

# Dyeing of wool with reactive dyes

## Drimalan F / Drimarene K

### Arguments:

Wool Gabardine  
Perspiration alcaline IWS TM 174

	Typ	Sample	CA	CO	PA66	PES	PAC	WO
1								
2								

Wool Gabardine  
Washing 50°C IWS TM 193

**1** = 4% Omegacrom Black S 200

	Typ	Sample	CA	CO	PA66	PES	PAC	WO
1								
2								

**2** = 6% Drimalan Black F-2R  
Aftertreatment: 20 min 85°C  
pH 8,5 with Ammonia

# Dyeing of wool with reactive dyes

## Drimalan F / Drimarene K

### Arguments:

Wool Gabardine

#### Overdyeing ISO X07

	Dyeing	Test	Wo	Co
1				
2				

#### Hot water 70°C

	Dyeing	Test	Wo	Co
1				
2				

1 = 4% Omegacrom Black S  
200

2 = 6% Drimalan Black F-2R  
Aftertreatment: 20 min 85°C  
pH 8,5 with ammonia

## 4. Dyeing wool with chrome dyes

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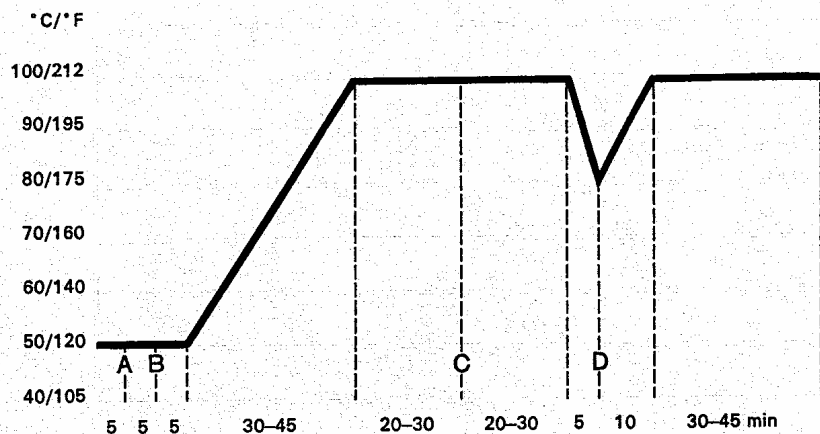
# Dyeing wool with chrome dyes

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- Chrome dyes contain groups capable of complexing with various metals. They form a stable, insoluble complex on the fibre with trivalent chromium. The most widely used dyeing method is the after-chroming process, which also gives the best fastness properties.

## Method I Dyeing at the boil and after-chroming

### Dyeing cycle



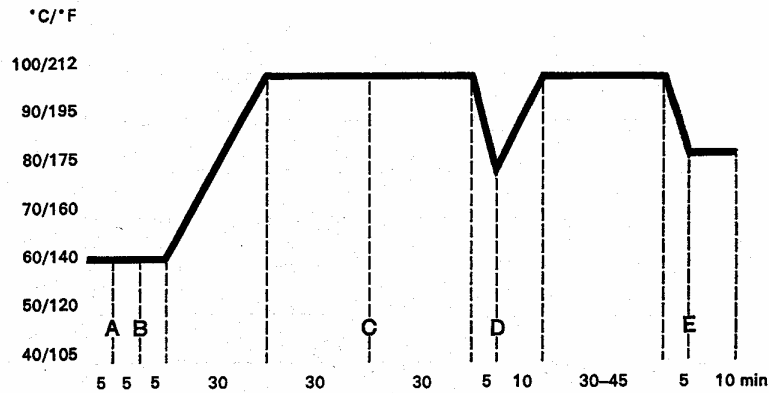
### Recipe

- A 1 -2 % acetic acid 80%  
 5 % Glauber's salt anhyd.  
*if necessary*  
 0.2 -0.5% Albigal A or SW  
 0.1 g/l Irgalon ST  
 pH about 5
- B x % dye
- C 1 -2\* % formic acid 85%  
 pH about 4
- D 0.25-1.5% potassium dichromate



**Method Ia**  
**Eriochrome Black T fine disperse 200%**

Dyeing cycle



Recipe

A 1 -2 % acetic acid 80%  
*if necessary*  
 0.1 g/l Irgalon ST  
 0.2-0.5% Albegal A or SW  
 pH about 5

B x % Eriochrome Black T fd. 200%

C 1 -2 % formic acid 85%  
 pH about 4

D 0.5-1.5% potassium dichromate

E y % ammonia (to remove the yellow-staining impurities)  
 pH about 8

rinse  
 acidify



## 5. Dyeing wool with 1:1 metal complex dyes

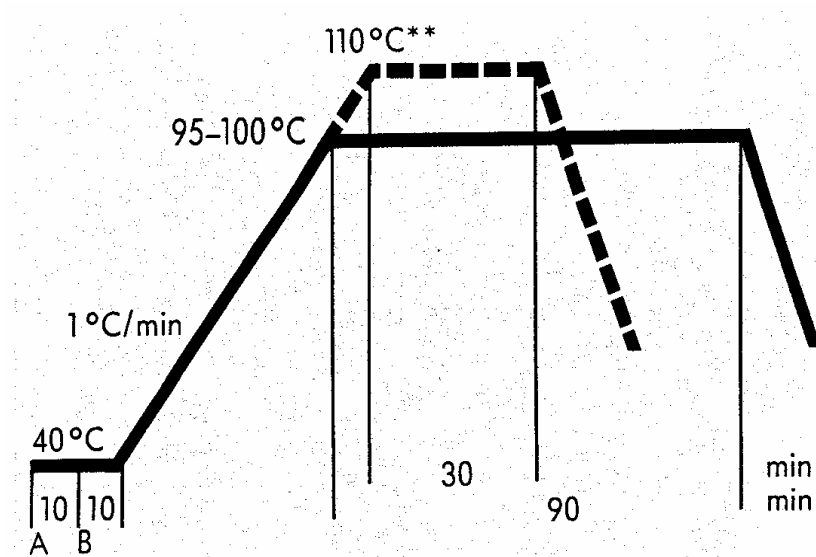
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# Dyeing wool with 1:1 metal complex dyes

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- 1:1 premetallised dyes are normally dyed at very low pHs in the order of 2-3 using sulphuric acid.
- Prolonged periods at the boil at these low pHs produce considerable damage to the wool fibre.
- Neolan P dyes and Albegal PLUS provide a 1:1 premetallised dyeing system for minimal fibre damage.

# Procedure



- A 0.5– 0.8 g/l Albegal FFA
  - 6 –10 % Glauber’s salt anhyd.
  - 2.5– 5 % formic acid 85%
  - 3 % Albegal PLUS\*
- pH 3.5–4
- B x % Neolan P dye

\* navy and deep shades 2%  
 \*\* 4% Irgasol HTW (dyeing at 110°C)

# 6. Dyeing wool with acid dyes

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# Dyeing of wool with acid dyes

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## Sandolan E

### Ideal dyestuff range for:

- piece dyeing
- precarbonised wool fabrics
- carpet yarns: pale – medium.

### Arguments for this dyestuff range:

- good penetration
- high migration
- simple trichromatic dyeing
- cover a large shade palette with few products
- elements with very high light fastness
- metal-free.

# Dyeing of wool with acid dyes

## Sandolan E

1/1 SD

Trichromatic elements

Sandolan Yellow E-2RL SGR

**AY 256**



Sandolan Red E-BNL SGR

**Mix**



Sandolan Blue E-BGL 200 SGR

**ABL 324**



## Further Sandolan E-dyestuffs

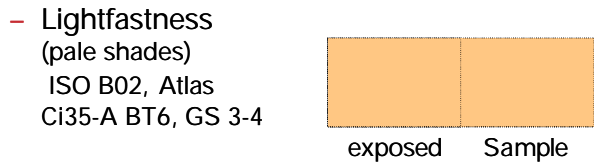
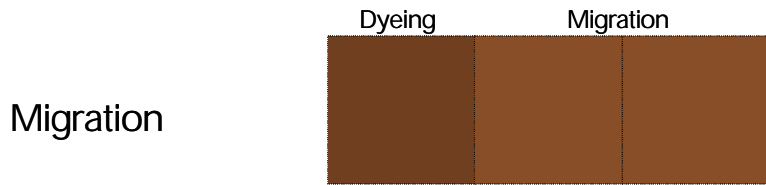
↓ Sandolan Yellow E-4GL 200	<b>AY 49</b>	Shade
↓ Sandolan Rubinole E-3GPL 180	<b>AR 57</b>	Price
↓ Sandolan Rhodamine E-BN 300	<b>AR 52</b>	Shade
↓ Sandolan Violet E-2R 300	<b>AV 126</b>	Shade
↓ Sandolan Blue E-2RL	<b>ABL 62</b>	Shade
↓ Sandolan Blue E-HRL 180	<b>ABL 182</b>	Wo/PA partition
↓ Sandolan Blue E-BL 200 SGR	<b>Mix</b>	Shade
↓ Sandolan Blue E-FGL 250	<b>ABL 72</b>	Wo/PA partition
↓ Sandolan Blue E-2GL 200	<b>ABL 40</b>	Shade



# Dyeing of wool with acid dyes

## Sandolan E

### Arguments:



# Dyeing of wool with acid dyes

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## Sandolan P/Fast P

Ideal dyestuff range for:

- hanks
- piece dyeing
- knitwear, piece and garment.

Arguments for this dyestuff range:

- good penetration
- high migration power
- classic trichromatic dyeing
- additional products to the Sandolan MF range
- metal-free.

# Dyeing of wool with acid dyes

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## Sandolan P/Fast P Trichromatic elements 1/1 SD



Sandolan Fast Yellow P-L 140 **AY 61**



Sandolan Fast Red P-L 150 **AR 118**



Sandolan Fast Blue P-LA 125 **Mix**

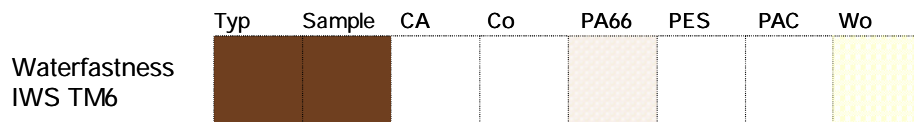
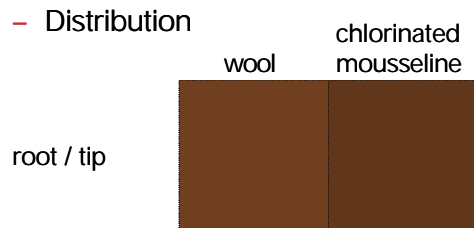
## Further Sandolan P/Fast P-Dyestuffs

- ↓ Sandolan Fast Blue P-FL 180 SGR **ABL278**  
Shade
- ↓ Sandolan Fast Blue P-RL 200 **ABL 129**  
Shade
- ↓ Sandolan Navy P-RL 125 **ABL 92**  
Build up

# Dyeing of wool with acid dyes

## Sandolan P / Fast P

### Arguments:



# Dyeing of wool with acid dyes

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## Sandolan MF

### Ideal dyestuff range for:

- cheese, yarn, piece and hank dyeing
- knitwear
- carpet yarns
- wool/polyamide blends.

### Arguments for this dyestuff range:

- best wet fastness of the migrating acid dyes
- simple trichromatic dyeing
- wool protective dyeing in the isoelectric region
- dyeing procedure with lowered temperature
- metal-free
- compact range, small inventory
- good Wo/PA partition.

# Dyeing of wool with acid dyes

## Sandolan MF

Trichromatic elements

1/1 SD

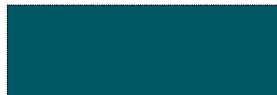
Sandolan Golden Yellow MF-RL **A067**



Sandolan Red MF-2BL SGR **AR 336**



Sandolan Blue MF-GL SGR **Mix**



### Further Sandolan MF-dyestuffs

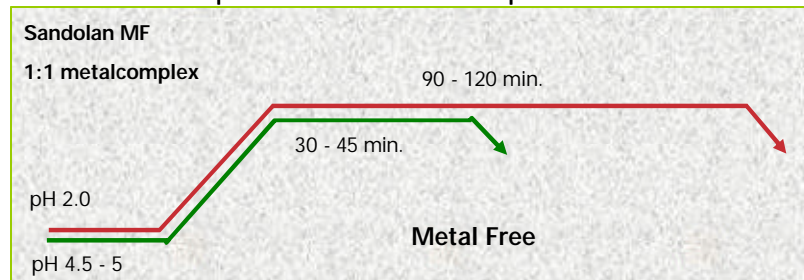
- ↓ Sandolan Yellow MF-2GLA SGR **Mix** Shade
- ↓ Sandolan Red MF-GRLN **Mix** PA/Wo blends
- ↓ Sandolan Dark Red MF-BR 150 **Mix** For dark reds
- ↓ Sandolan Blue MF-2RLA SGR **Mix** Shade
- ↓ Sandolan Blue MF-BLN SGR **ABL 350** wetfast
- ↓ Sandolan Blue MF-5GL 200 SGR **ABL 280** Shade
- ↓ Sandolan Dark Blue MF-2B 300 **ABL 61:1** Build up
- ↓ Sandolan Navy MF-RL 200 **Mix** Build up
- ↓ Sandolan Green MF-BL **AG 25** Shade

# Dyeing of wool with acid dyes

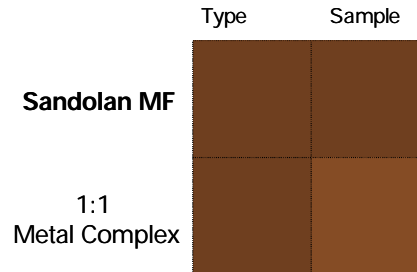
## Sandolan MF

### Arguments:

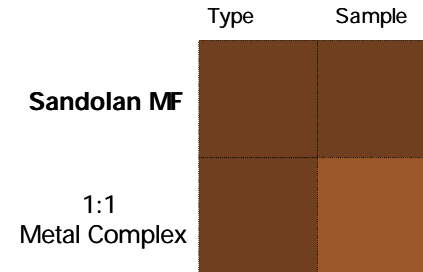
- Sandolan MF compared to 1:1 metalcomplexes



- Influence of perborate according to ISO C06 A2S



- Influence of peroxide according to ISO N02



# Dyeing of wool with acid dyes

## Sandolan MF

### Arguments:

- Perspiration alkaline IWS TM 174

	Typ	Sample	CA	CO	PA66	PES	PAC	WO
<b>Sandolan MF</b>								
AY 17/AR1 ABL 40								

- Water IWS TM 6

	Typ	Sample	CA	CO	PA66	PES	PAC	WO
<b>Sandolan MF</b>								
AY 17/AR1 ABL 40								



# Dyeing of wool with acid dyes

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## Sandolan N / Milling N

### Ideal dyestuff range for:

- yarn dyeing
- dyeing loose stock and tops
- vigoureux printing.









### Arguments for this dyestuff range:

- large offer of products for all fastness requirements
- brilliant shades
- commercially interesting products
- metal-free
- products with high versatility also on silk
- polyamide, hairs and wool blends.

# Dyeing of wool with acid dyes

## Sandolan N / Milling N

### Main elements

		1/1 SD
Sandolan Milling Yellow N-7GL SGR	AY 218	
Sandolan Milling Yellow N-L	AY236	
Sandolan Milling Red N-GS SGR	--	
Sandolan Milling Red N-4BL	AR 260	
Sandolan Milling Violet N-FBL 180 SGR	AV 48	
Sandolan Milling Blue N-2RFL 160	ABL225	
Sandolan Milling Blue N-GLN 180	ABL 127:1	
Sandolan Milling Green N-BL 130	AG 40	

### Additional elements

↓ Sandolan Milling Scarlet N-GWL 130	AR 111
↓ Sandolan Scarlet N-GL 130	AR 145
↓ Sandolan Scarlet N-GR	AR 374
↓ Sandolan Milling Red N-3BLA	Mix
↓ Sandolan Brilliant Red N-BG 125	AR 249
↓ Sandolan Milling Red N-FBL 150	AR 143
↓ Sandolan Milling Red N-2B	AR 154
↓ Sandolan Brilliant Red N-3B 140	AR 131
↓ Sandolan Milling Red N-6B 140	AV 54
↓ Sandolan Milling Blue N-BL 150 SGR	ABL 80
↓ Sandolan Blue N-2F 300	ABL 61:1
↓ Sandolan Cyanine N-6BN 275	ABL 83
↓ Sandolan Cyanine N-GN 360	ABL 90
↓ Sandolan Brilliant Blue N-5GM 210	ABL 142
↓ Sandolan Navy N-5RL 220/N-5RLA 220	ABL 113
↓ Sandolan Milling Green N-6GLN	AG 81
↓ Sandolan Black N-BR	Mix

# Dyeing of wool with acid dyes

## Sandolan N / Milling N

### Arguments:

- Sandolan Milling Yellow N L

	Dyeing	Test	Wo	Co
Hot water 70°C	Yellow	Yellow	Yellow	White

	Dyeing	Test	Wo	Co
Milling alkaline	Yellow	Yellow	Yellow	White

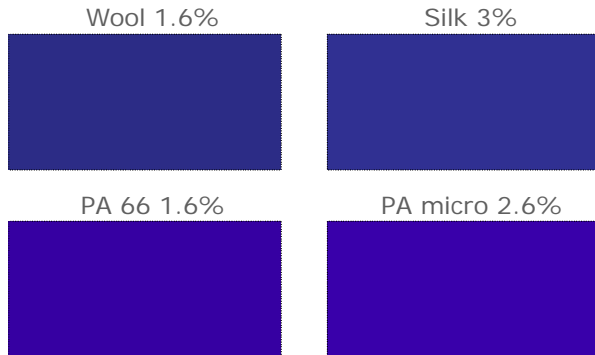
	Typ	Sample	CA	Co	PA66	PES	PAN	Wo
Perspiration alkaline IWS 174	Yellow	Yellow	White	White	White	White	White	Yellow

# Dyeing of wool with acid dyes

## Sandolan N / Milling N

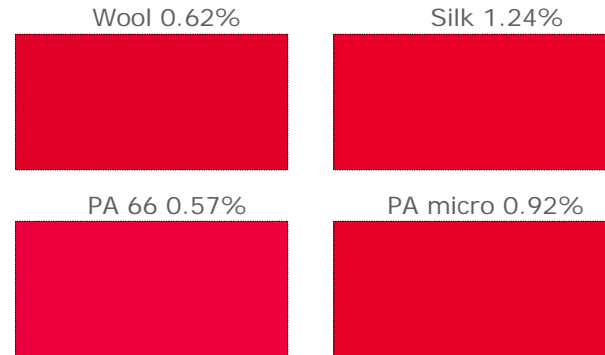
### Arguments:

- Sandolan Milling Blue N-2RFL 160  
Versatility



### Arguments:

- Sandolan Milling Red N-GS SFR  
Versatility and strong build up



# Dyeing of wool with wool fast dyes

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## Lanasan

### Ideal dyestuff range:

- yarn dyeing
- dyeing loose stock and tops
- vigoureux printing.

### Arguments for this dyestuff range:

- identical dyeing behaviour and combinability
- optimised root/tip distribution
- cover a large shade palette with few products
- wool protective dyeing in the isoelectric region
- high reproducibility colorimetry/lab/dyehouse.

# Dyeing of wool with wool fast dyes

## Lanasan

Trichromatic elements  
1/1 SD

Lanasan Yellow CFC **Mix**



Lanasan Red CFA **Mix**



Lanasan Grey CFA **Mix**



## Further elements

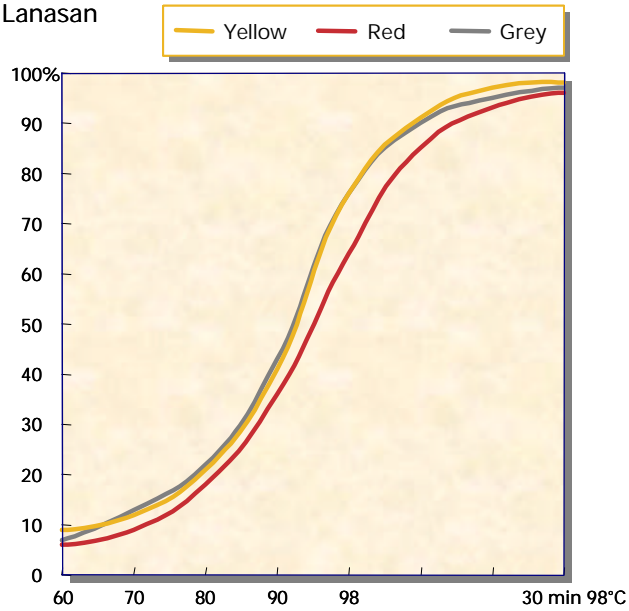
- ↓ Lanasan Brilliant Yellow CF-BA **Mix** Shade
- ↓ Lanasan Yellow CFA **AY 235** Shade
- ↓ Lanasan Brilliant Red CF-BA **Mix** Shade
- ↓ Lanasan Red CFB **AR 315** Price
- ↓ Lanasan Bordeaux CFA **Mix** Light
- ↓ Lanasan Brill. Blue CF-BA **Mix** Shade
- ↓ Lanasan Blue CF **Mix** Shade
- ↓ Lanasan Navy CFA **Mix** Fastness
- ↓ Lanasan Brown CFA **Mix** Shade

# Dyeing of wool with wool fast dyes

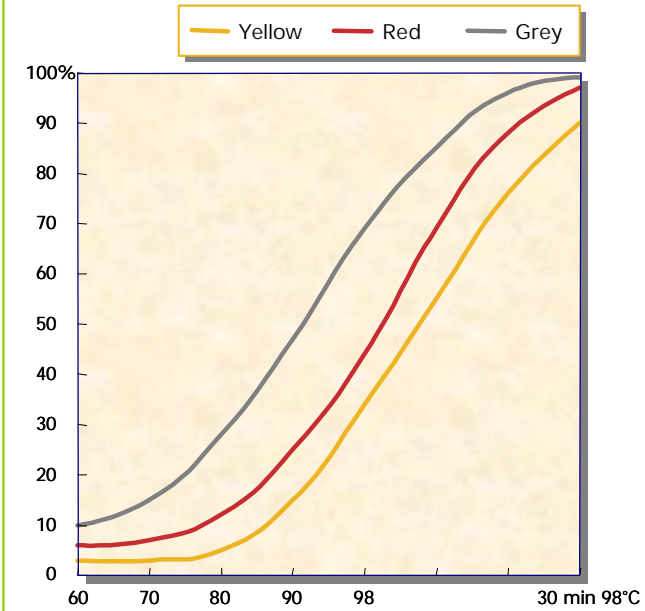
## Lanasan

Arguments: Dyeing behaviour

Lanasan



1:2 metalcomplex dyes mono-/disulfonated



# Dyeing of wool with wool fast dyes

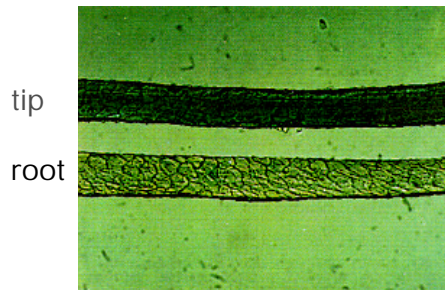
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## Lanasan

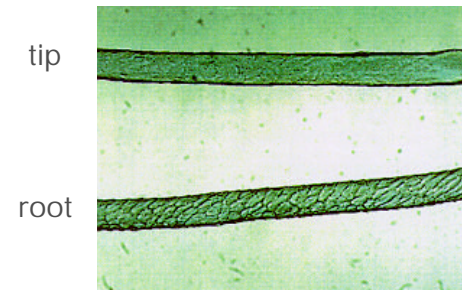
### Arguments:

- Dyeing of wool roots and tips.

C.I. AY 127 / C.I. ABL 80



Lanasan Brill. Yellow CF-BA / Brill.Blue CF-BA





## 7. Multicolour effects on wool

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# Sandospace R paste

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Special agent which modifies the affinity of polyamide fibres and wool for dyestuffs:

- reacts with the amino groups of polyamide or wool
- reduces the affinity of the fibres for anionic dyes
- increases the affinity of the fibres for cationic dyes
- can be applied by exhaust, continuous and printing processes.

# Sandospace R paste

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## 1 Properties

Appearance	white, viscous paste
Chemical character	heterocyclic compound
Ionic character	anionic
Density at 20°C	ca. 1.25
pH (undiluted)	ca. 6
Storage stability	at least 6 months at 20-25°C (higher storage temperatures may lower the product's effectiveness)
Stability of solutions to hard water, salts, acids alkalis	good good act as a catalyst
Compatibility with anionic & non ionic products cationic products	good precipitation is possible
Foaming tendency	none
Ecotoxicological data	see Safety Data Sheet

# Sandospace R

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## Mode of action

- Sandospace R paste is a reactive anionic product which reacts like a reactive dye with the amino groups of polyamide or wool.
- Sandospace R paste modifies the affinity of the fibres for dyestuffs. The fibres treated with Sandospace R paste show reduced affinity for anionic dyes (a white reserve is obtained when the product is used at higher dosage) and increased affinity for cationic dyes; the affinity for disperse dyes is unchanged.

## Scope of application

- Sandospace R paste can be applied to polyamide fibres and wool in the various forms (loose fibres, yam, woven, knitted or tufted goods) by printing, space dyeing, padding and exhaust processes. Due to their similar fixation conditions Sandospace R Paste can also be applied alongside Sandospace MPW Liquid. This allows a wide variety of colouristic possibilities.

# Sandospace R

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## Application

- Sandospace R Paste can be applied by padding and exhaust methods (total application) as well as by printing and space-dyeing (partial application). In the continuous processes the fixation is carried out with saturated steam.
- The amounts of Sandospace R Paste may vary in a large domain of concentrations (as guiding values 1-8% o.w.f) depending on the affinity of the substrate, the application method and the required effects.
- Sandospace R Paste has a tendency to hydrolyse; it should therefore be dissolved or dispersed in water at room temperature. Do not boil. It is advisable to prepare pad liquors and printing pastes shortly before application, particularly those containing small amounts of Sandospace R.

# Sandospace R

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## Total application of Sandospace R Paste

### *Exhaust method*

- Set bath at room temperature with  
x % Sandospace R paste  
at pH 4 (or below) or better with pH shifting from the neutral to the acid region with 1-2 ml/l Sandacid VS Liq. or Sandacid VS Liq. conc.
- Raise from room temperature to 98°C at 1.5 - 2°C/min so as to ensure uniform uptake and good distribution of the product.
- Fixation 15-45 min at 98°C.
- Rinse hot then cold.

# Sandospace R

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## Total application of Sandospace R Paste

*Continuous method (padder or one-side application technique)*

Pad liquor	x g/1 Sandospace R paste 0-20 g/1 salt (common or Glauber) 5-10 g/1 sodium bicarbonate <u>or better</u> 10-30 g/1 Drimagen® salt FD Gran.
Pad	60-80% pickup
Fixation	5-10 min at 100-102°C (saturated steam)
Rinse	hot then cold.

Remark: The addition of Drimagen salt FD Gran, in the pad liquor improves the fixation of Sandospace R paste and enhances the reserve effects.

# Sandospace R

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## Overdyeing goods partially treated with Sandospace R Paste

- Virtually all discontinuous exhaust dyeing processes are suitable for overdyeing. Carpets can also be overdied on continuous dyeing ranges by the pad steam process.
- The properties required of the dyes, i.e. dye selection above all in view of the differentiation and the dyeing conditions are the same as for dyeing differential dyeing polyamide fibres.
- Anionic dyes are suitable in principle, provided they satisfy the fastness and process requirements. However, the differentiation power decreases as the dye's own affinity to the fibre and the amount increase.



# Sandospace R

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- The differentiation depends directly on the dyeing pH, i.e. the lower the pH the lower the differentiation between Sandospace R-treated and untreated goods.
- Nonionic to weakly cationic products, such as Sandogen® NH Liquid, promote the differentiation.
- When dyeing goods treated with Sandospace R Paste (or S Liquid) and Sandospace MPW Liquid these products prevent:
  - mutual precipitation of basic and anionic dyes
  - staining of untreated and treated fibres by the opposite dye components.
- Anionic products reduce the contrasts.

# Sandospace R

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## Stripping

- Sandospace R Paste is very difficult to remove from the fibre, if at all, since it forms a covalent bond with the amino groups of the polyamide fibre and therefore does not have any migration power either.
- However, it is possible to overdye treated PA with disperse dyes. Dyeings of perfect levelness are obtained because Sandospace R paste does not affect the dyeing behaviour of the polyamide fibres with disperse dyes.

# Multicolour effects with Sandospace R

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# Multicolour effects with Sandospace R

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## 8. Stripping dyes from wool

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# Stripping dyes from wool

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- Because of the large number and different types of binding sites for dyes in wool, **many dyes are very difficult to remove** because they have high affinity for the fibre.
- Only dyes, such as some acid dyes, with low affinity and high migrating power, can be partially removed.
- Some dyes can be destroyed completely or partially by using a reducing agent, but the wool may still remain somewhat yellow or discoloured and sustain some degree of damage.
- Reactive dyes cannot be removed because they become chemically bound to the fibre during the dyeing process.
- Unsatisfactory dyeings are often overdyed black.

# Stripping dyes from wool

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- Partial stripping of some acid dyes can be accomplished by treating the dyed material at the boil with a bath containing 20 to 30% sodium sulphate for about one hour. This treatment is used to remove just small amounts of dyes.
- For removal of larger amounts a very slightly alkaline bath can be considered. Ammonia can be used but the pH should not exceed pH 8-8.5, in order to avoid too much damage to the wool.
- The addition of a polymeric (cationic) dye complexing agent to the stripping bath may also aid dye removal.
- Almost complete decomposition of certain (mainly azo) dyes can be achieved with zinc-sulphoxylate-formaldehyde. This reducing agent requires an acidic pH which is favorable to wool. The reduction of the dyes is carried out at or near the boil at a pH of 4.5-5, for 20-30 min. The resulting colour may not be white.
- ColourClear (Rohm and Haas) is a two-component stripping agent based on a reducing agent used at pH 7 and is suitable for wool.

## 9. Preserving the quality of wool

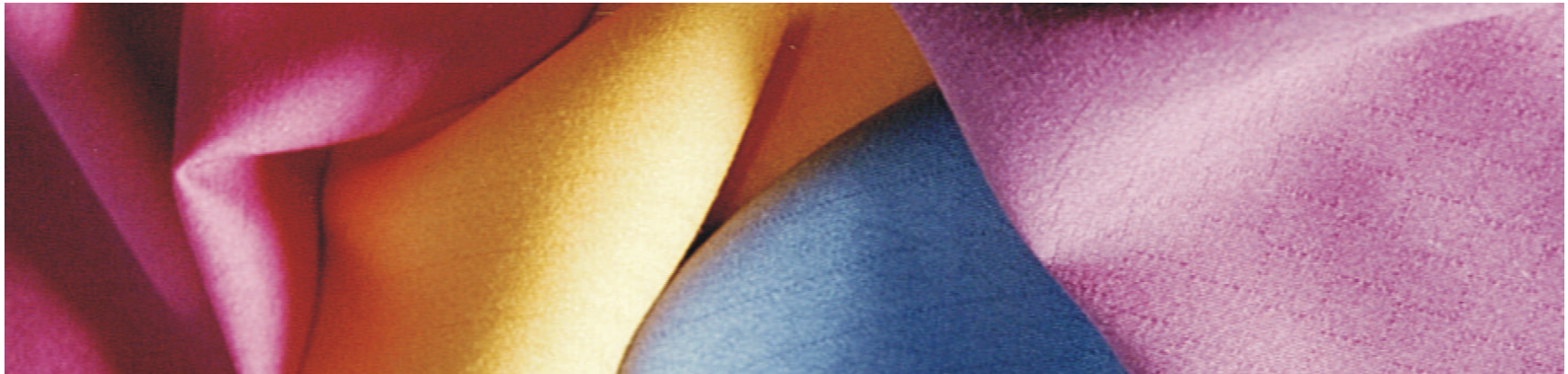
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# The Sirolan-LTD™ process

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A new method for dyeing wool at low temperature or for a short time at the boil



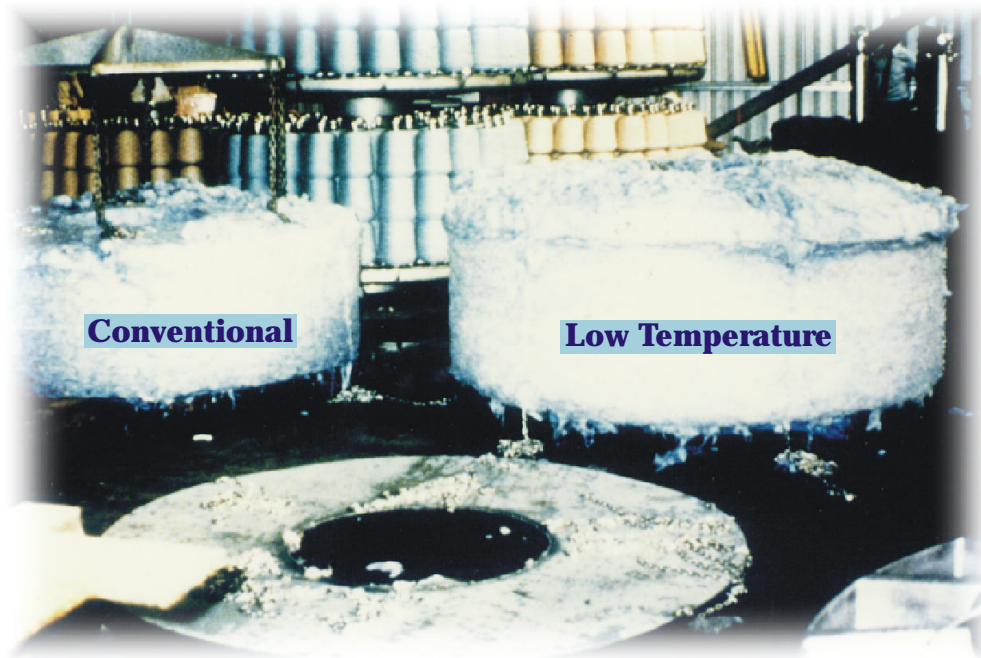
# Better exhaustion of dyes

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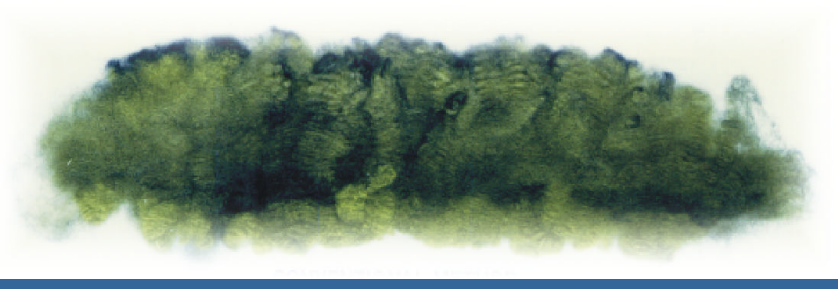
# Greater bulk and openness of loose stock

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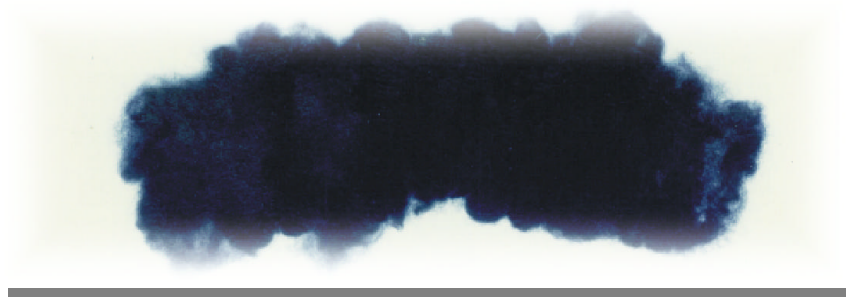


# 'Tippiness' in wool dyeing

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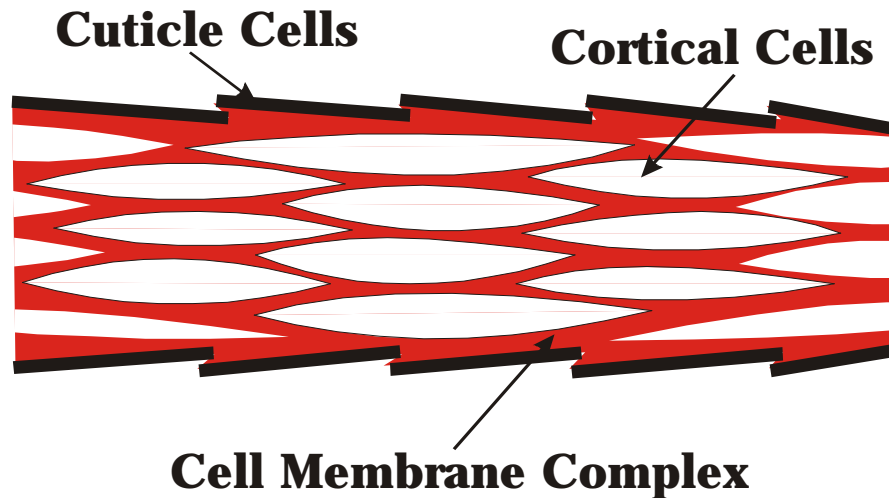


**Conventional method**

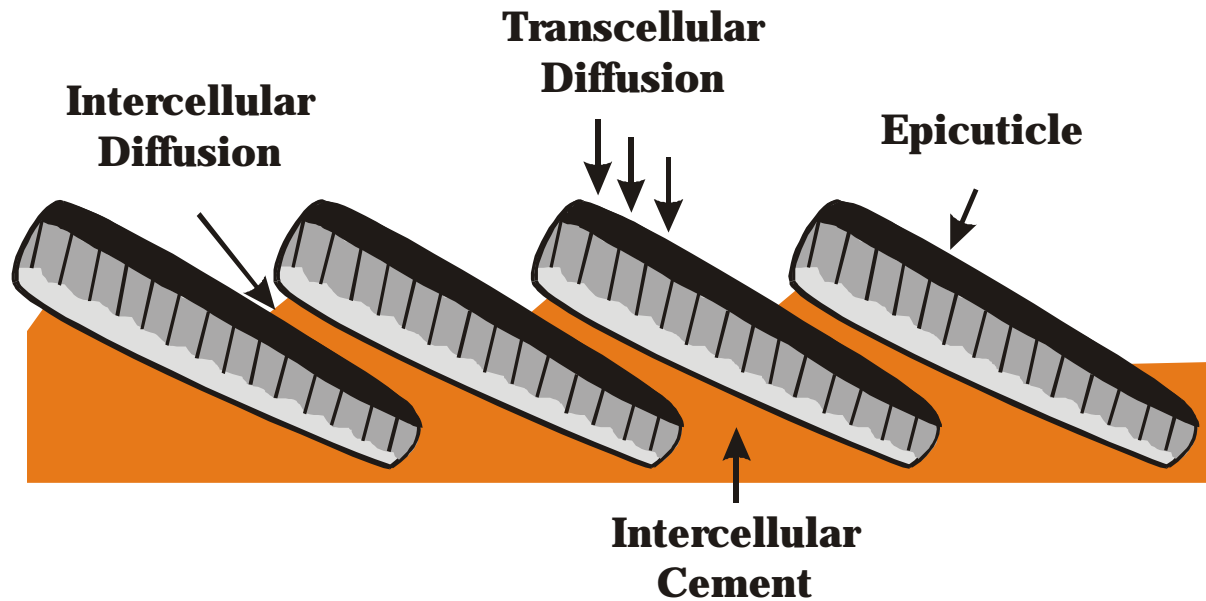


**Sirolan-LTD™ method**

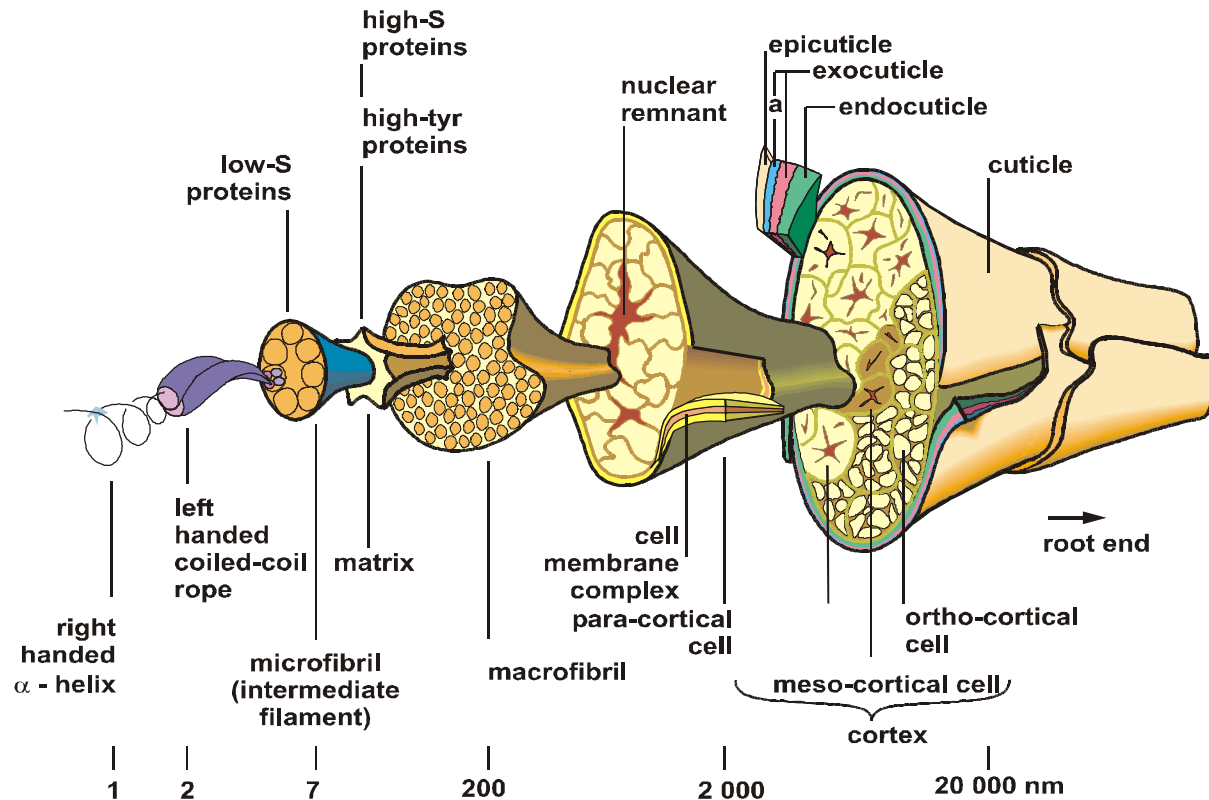
The interior consists of long, cortical cells between which is a continuous phase (the cell membrane complex). Compared with the rest of the wool fibre, the cell membrane complex is a region of relatively low crosslink density.



# The surface of a wool fibre consists of overlapping cuticle cells (scales)



# Wool fibres have a complex physical structure



- Wool is usually dyed for prolonged times at the boil. These conditions can cause significant fibre damage.
- Damage during dyeing has an adverse effect on performance and yields in downstream processing and on quality of the final wool products.

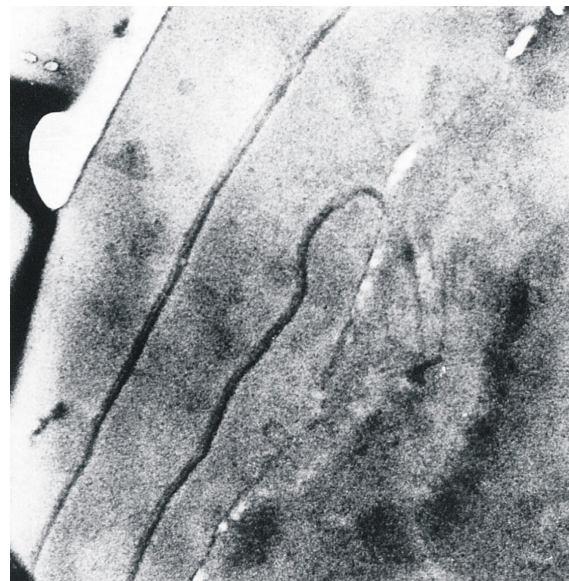


**Light micrograph showing dye entering a wool fibre between the scales.**

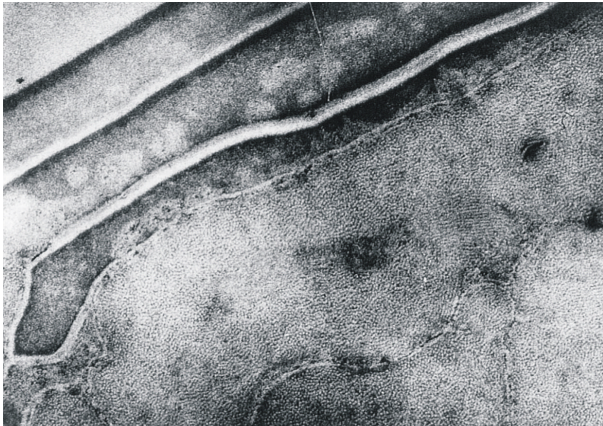


**Diffusion of dyes along the cuticle cell membrane complex.**

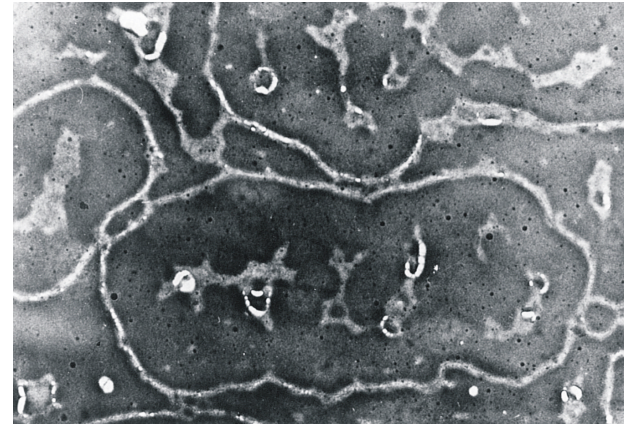
**Transmission Electron Micrograph (TEM)**



**Dyeing of the  
sulphur-rich regions  
of the wool fibre at  
equilibrium (TEM)**



**Undyed non  
keratinous  
components at  
equilibrium (TEM)**



## Fundamental research by CSIRO Textile and Fibre Technology has shown how dyes diffuse into wool

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- Dyes enter wool fibres at the junctions between the scales.
- In the early stages of a dyeing cycle, dyes diffuse throughout wool fibres along the lightly crosslinked region of the cell membrane complex, between the cortical cells.
- As the dyeing cycle proceeds, dye molecules progressively transfer from the cell membrane complex into the more highly crosslinked regions of fibre; in particular the high-sulphur proteins of the matrix WITHIN the cortical cells.
- At equilibrium, the cell membrane complex, which is important in the early stages of the dyeing cycle, is devoid of dye.

## Compared with conventional wool dyeing methods, the Sirolan-Ltd process gives:

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Decreased fibre damage



Processing benefits

Better exhaustion of dyes and insect-resist agents



Decreased effluent load

Less yellowing in dyeing



Brighter shades

Excellent coverage of tippiness



Better quality dyeings

Greater bulk and openness of loose stock



Easier drying and blending

# Low temperature dyeing

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The Sirolan-Ltd wool dyeing process

- Improved product quality with economic benefits and cleaner effluent.

# The Sirolan-Ltd dyeing procedure

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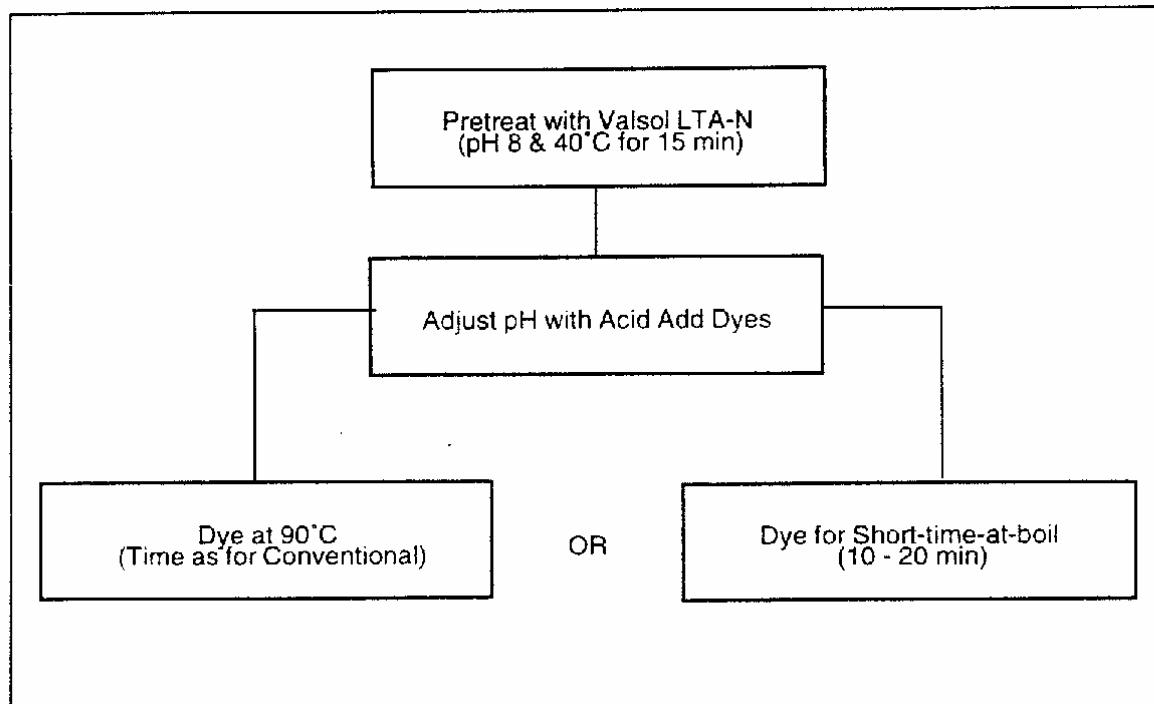
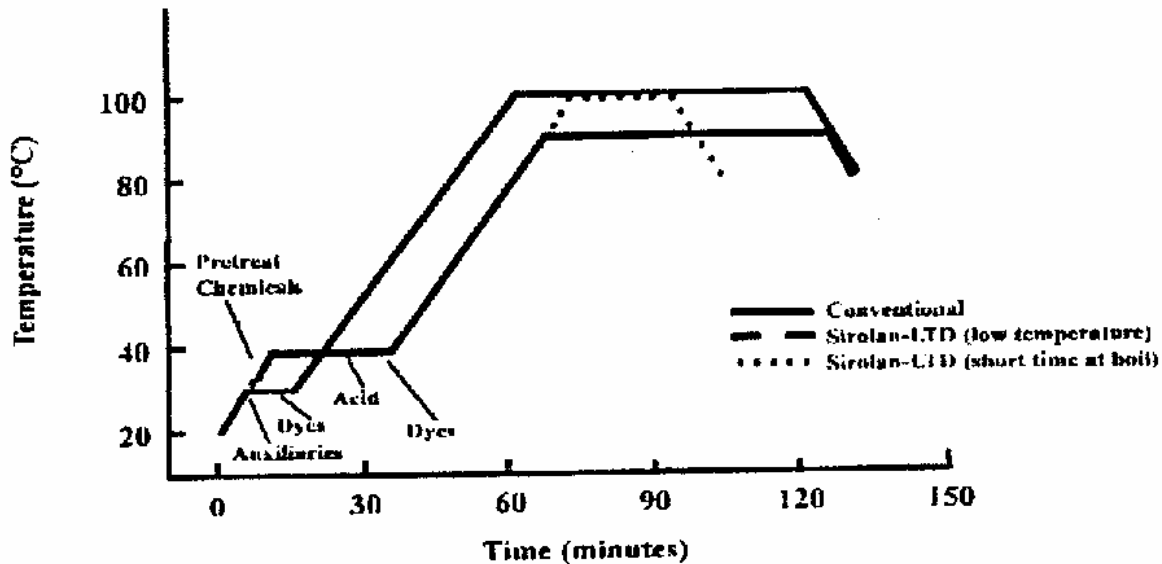


Fig. 1 - The Sirolan-LTD Dyeing Procedure.

# Conventional and Sirolan-Ltd dyeing methods

CONVENTIONAL AND SIROLAN-LTD DYEING METHODS



## Dyeing at low temperature or for a short time at the boil

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Industrial experience has shown that by using Valsol LTA-N in the dyeing procedure, the time required at the maximum temperature can be considerably reduced compared to the normal dyeing cycle, e.g. 30 to 50% of the time at maximum temperature compared to conventional.

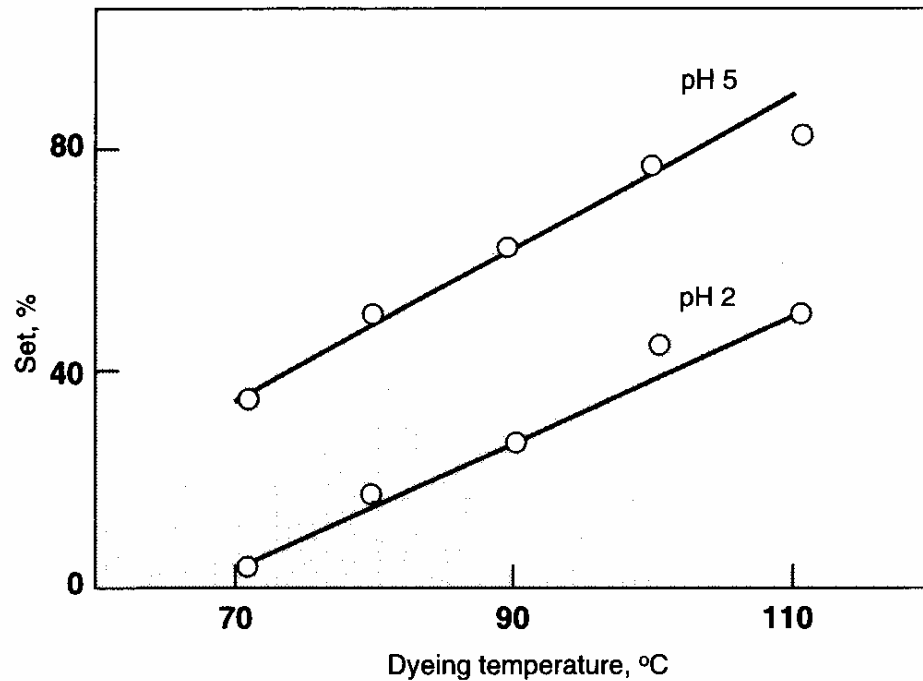


# The BASOLAN AS process: a new concept in wool dyeing

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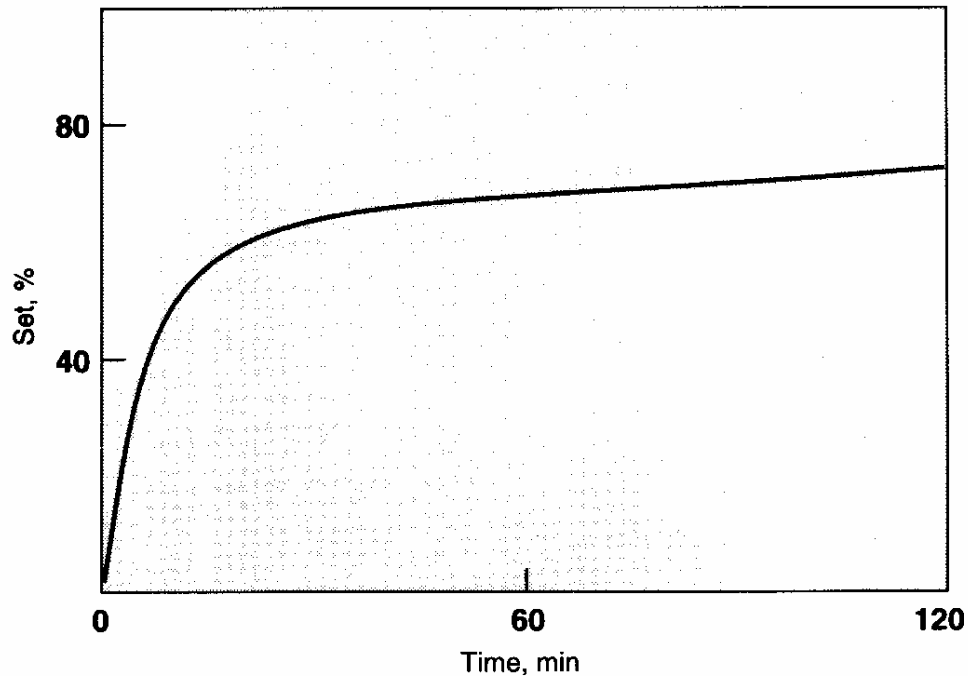
- The Basolan AS process is a new approach to dyeing wool. The process restricts the deterioration of wool properties which occurs as a result of dyeing.
- This is achieved through a reduction in the extent to which wool is permanently set during dyeing.
- Two options are available to the dyer, and all that is involved is the addition of anti-setting chemicals to the wool dyebath.
- Processing and product benefits can be obtained for wool dyed as loose fibre, top, yarn (package or hank) and woven fabric by using Basolan AS.

## Relationship between dyeing conditions and permanent set (for a dyeing time of 1h at max temperature)



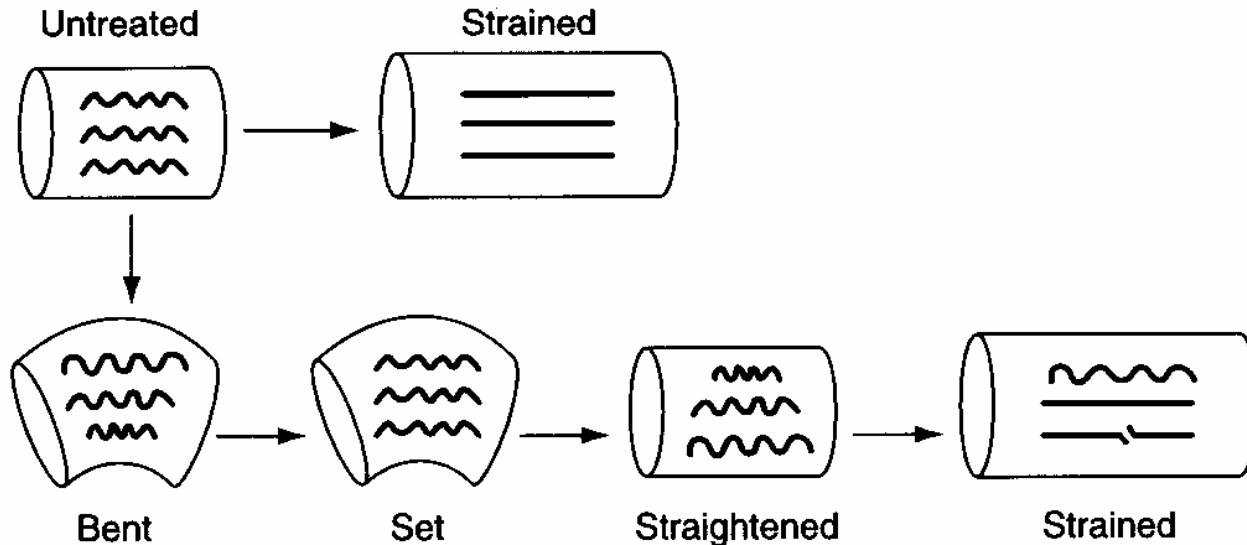
**Figure 1** Relationship between dyeing conditions and permanent set (for a dyeing time of 1 h at maximum temperature)

# Relationship between permanent set and dyeing time at 100°C (pH4.5)



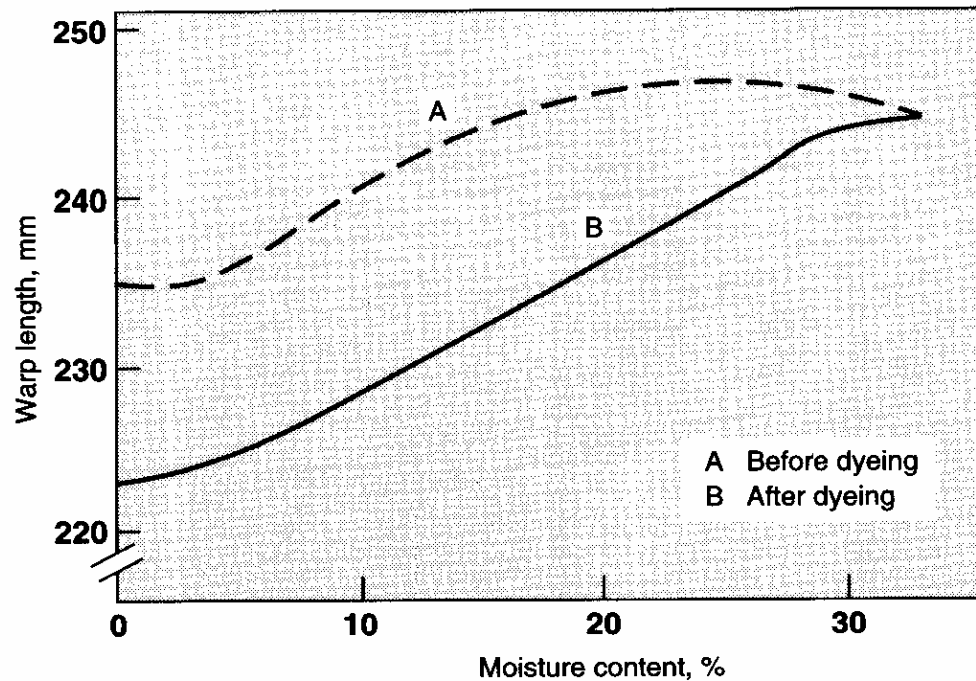
**Figure 2** Relationship between permanent set and dyeing time at 100°C (pH 4.5)

# Effect of setting and curvature on the tensile failure properties of wool fibres

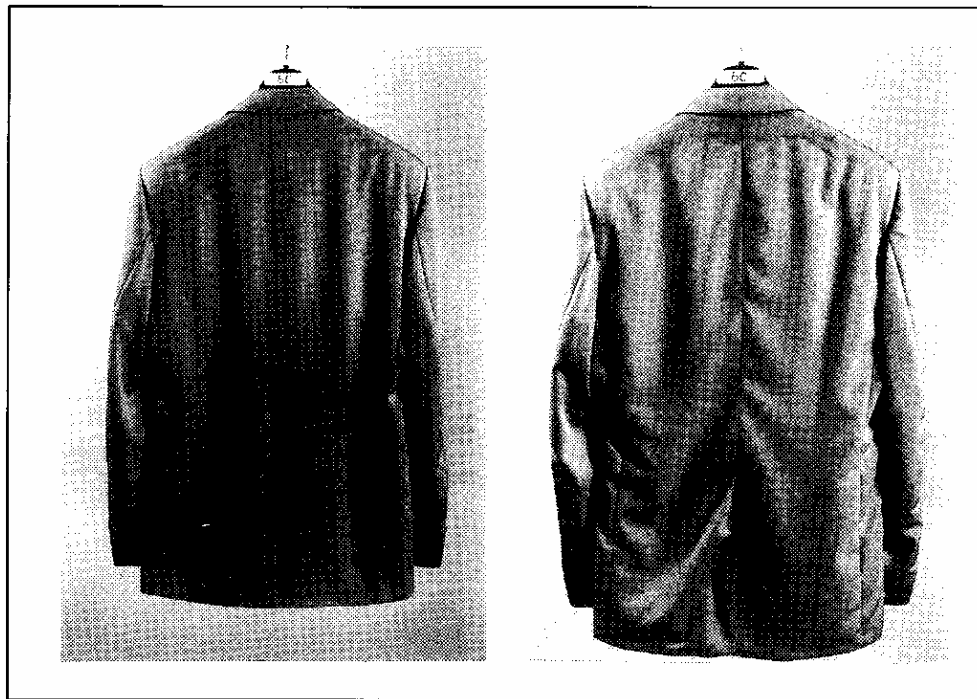


**Figure 4** Effect of setting and curvature on the tensile failure properties of wool fibres

# Effect of dyeing on the hygral expansion of a 2/1 twill gabardine fabric

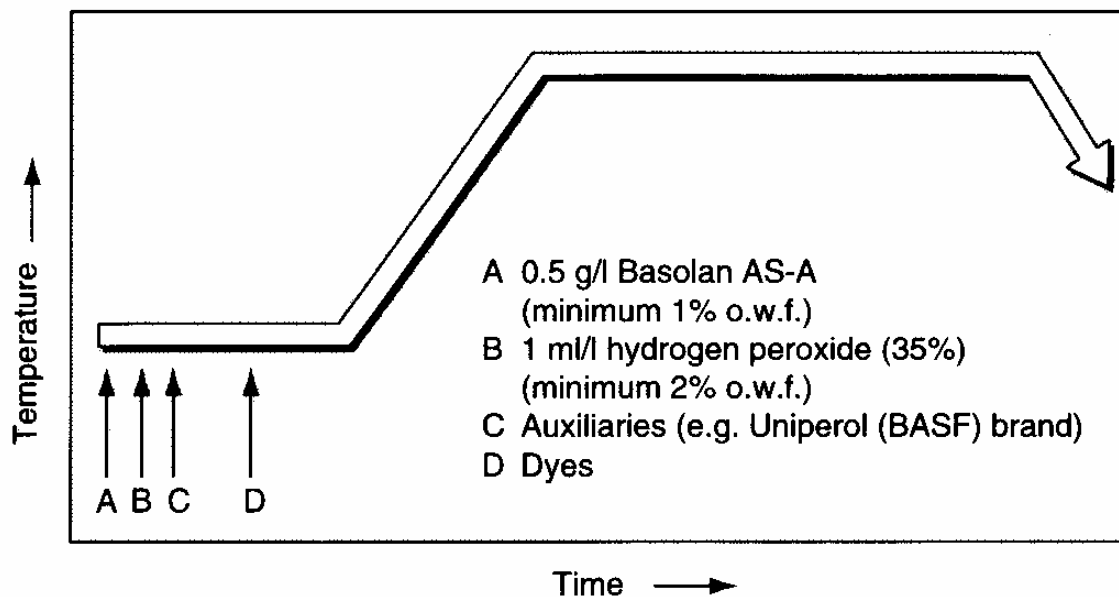


**Figure 5** Effect of dyeing on the hygral expansion of a 2/1 twill gabardine fabric



**Figure 6** Effect of hygral expansion on the appearance of a men's jacket made up from a piece-dyed gabardine fabric with a warp hygral expansion of 10.1%; the picture on the left figure shows the garment after pressing and conditioning to 65% RH (20°C), and the one on right shows the same garment after spraying with a light mist of water

# Profile for dyeing with Basolan AS-A + hydrogen peroxide



**Figure 7** Profile for dyeing with Basolan AS-A + hydrogen peroxide