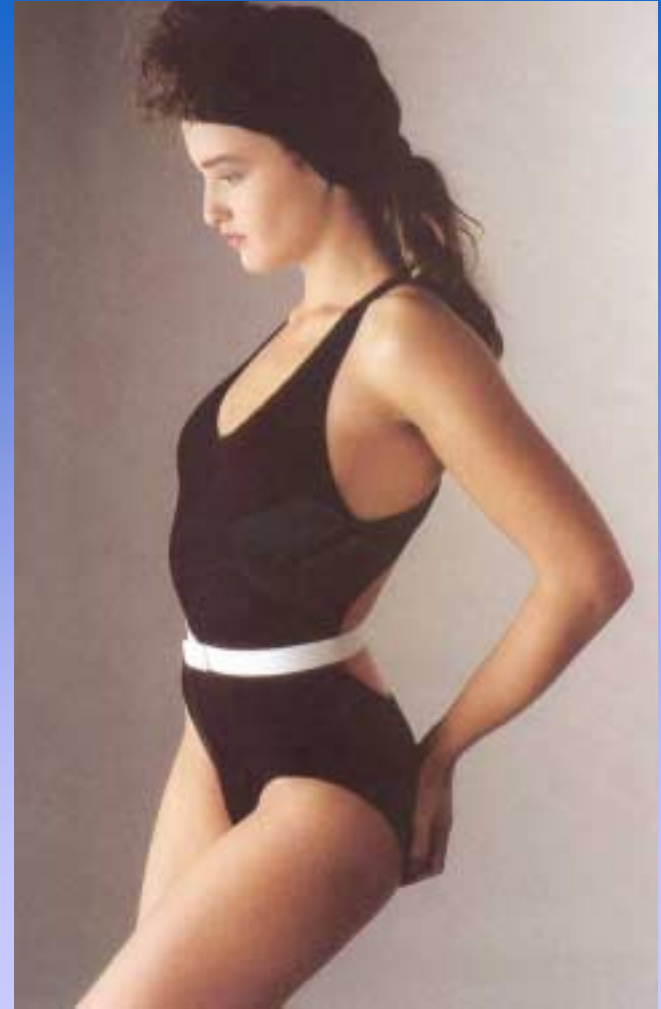


Fibre blends with elastane

Recommendations for
pretreatment and dyeing



Precautions

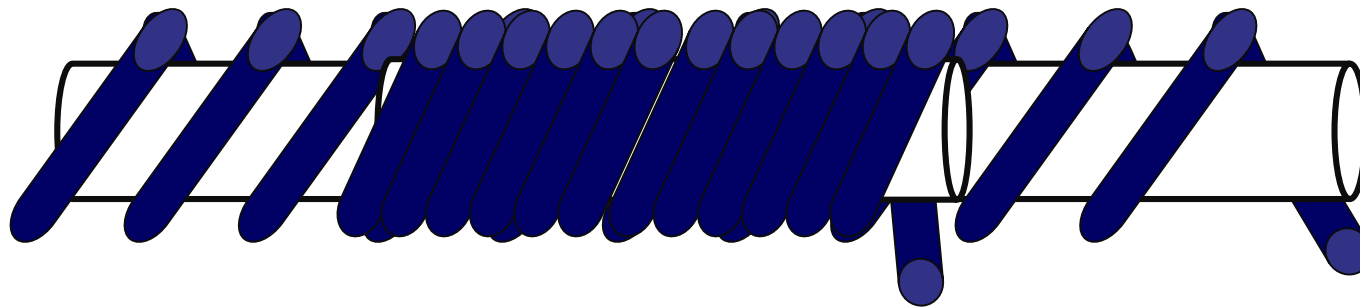
- Long term storage of fabrics should be avoided - if unavoidable seal in airtight, opaque plastic foil (to protect from degrading oxides of nitrogen, and sunlight)
- High amounts of silicone oils and other lubricants are used in spinning and winding
- During weaving and knitting further oils and auxiliaries are applied to ensure good running properties.
- Degradation of these products can lead to yellowing or loss of elasticity.
- 'Cold setting' can cause permanent crease marks. Circular knits are best slit on knitting machine and rolled open width.



Processing

Elastanes are knitted/woven under tension which :

- **allows “jamming” or compaction of the fabric.**
- **“buckles” the hard fibre in “jammed” fabric.**



The fabric should be relaxed prior to heat-setting to avoid rope marks and puckering during dyeing, and ensure good dimensional stability in the final garment.

RELAXATION 1

The process of “settling” the tension in the fabric, to allow full development of the elasticity. The fabric will become fully “jammed”.

Relaxation = Hot + Wet

Benefits of Relaxation

Reduces potential distortion or deformation of the fabric from residual uneven tension.

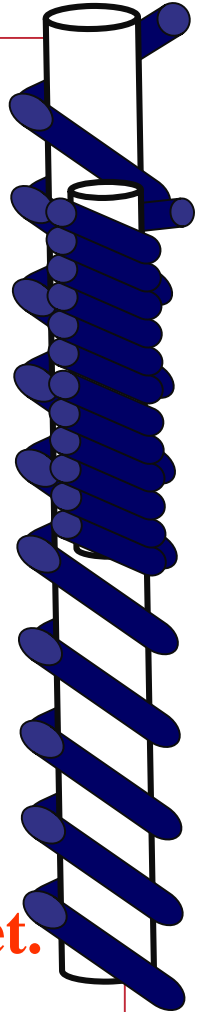
(e.g. : slits, islands, uneven puckering)

Pre-shrinks the goods ready for correct setting.

Develops full “power” and recovery.

Required for Desizing woven goods before Heat Set.

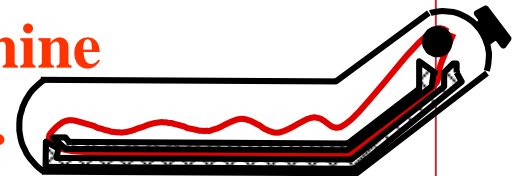
Relaxation before long storage is preferred.



RELAXATION 2

Relaxation Methods for Elastanes

- **Steaming**
- **Steam Table or Steam Frame in front of Stenter**
(Steaming and drying in a stenter should be a separate step before Heat Setting.)
- **Hot wash or scour e.g on a Softflow machine**
This can be coupled with a scouring step.
- **Hot solvent scour (continuous washer).**



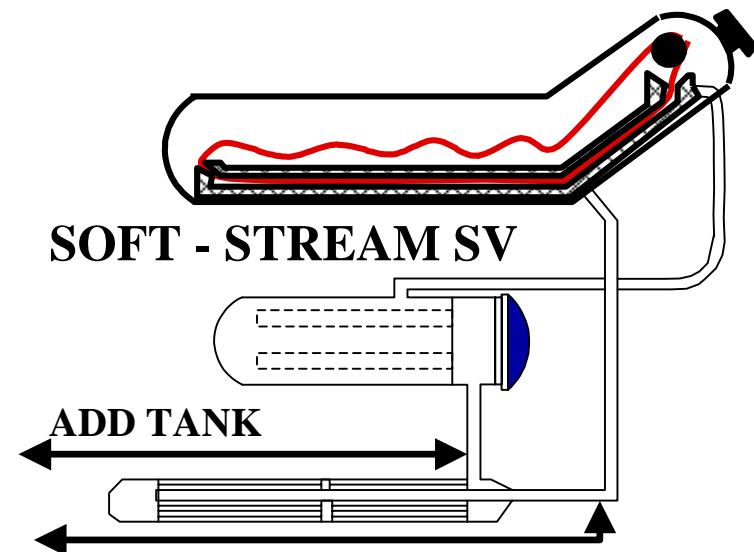
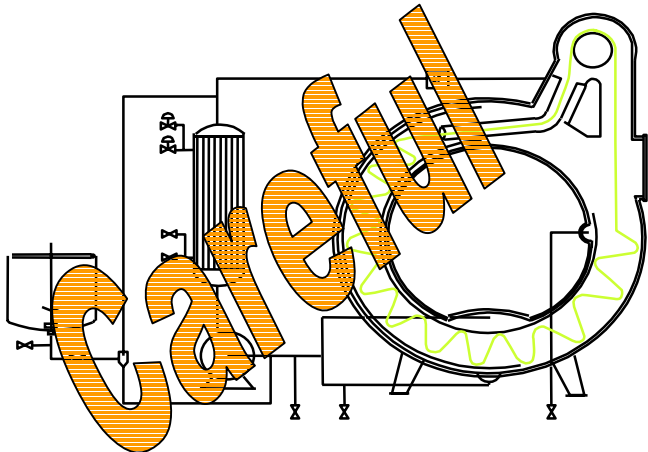
Combined (Single Pass) Steam Relaxing and Heat Set gives a less uniform result compared with two separate steps.

Machines 1

The best wet processing machines for Elastanes feature :

- **Low or controlled tension,**
 - ◆ - short distance to lift roll/winch (a small rise).
 - ◆ - lots of water pumping action to support.
- **Good turbulence with wet processing.**

Overflow rinse with hot water & Cool to 50 C before drop !

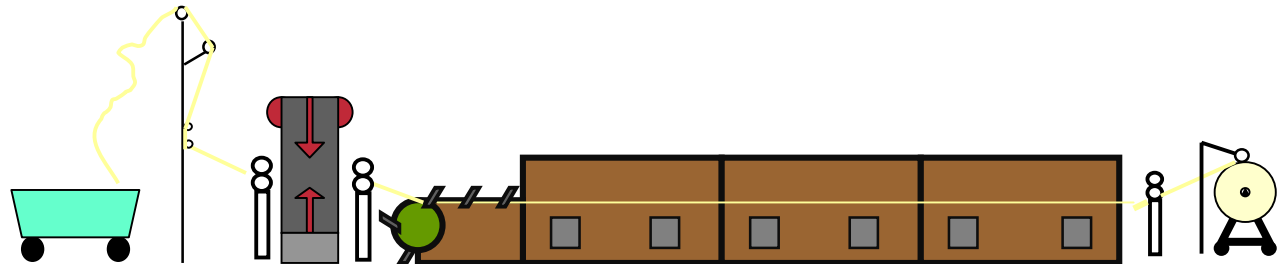


Machines 2

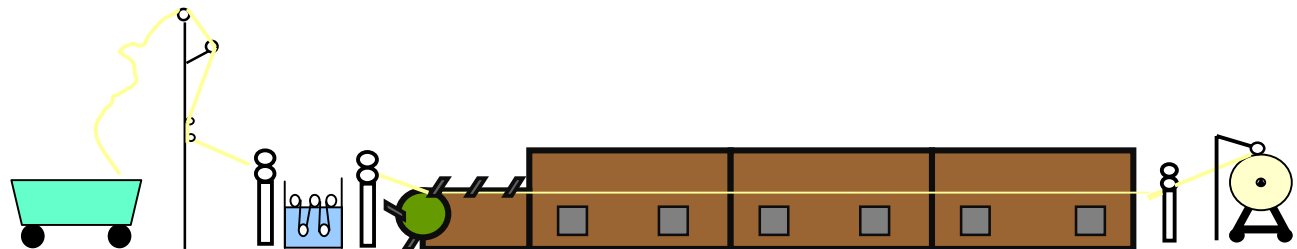
The best dry processing machines for Elastanes are :

- Electric heated, to minimise fumes.
- Steaming capacity to facilitate relaxation.
- Overfeed capacity to facilitate optimum properties.

Steam Frame



Pad Frame

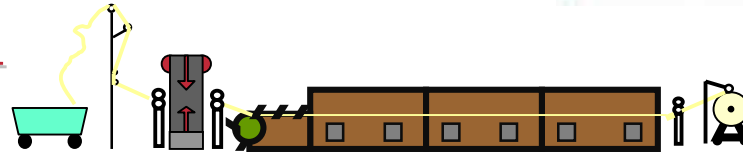


Risks

For reasons of economy Elastane blends are often relaxed and heat set before dyeing and finishing, but this entails risk.

- **Spinners advise against use of self-emulsifying oils in knitting or weaving**
- **Impurities and degradation products of lubricants can be baked into fabric during heat-setting, difficult to remove in scouring.**
- **Fumes from impurities during heat setting cause environmental problems and staining of the stenter by condensation products**
- **Scouring before heat-setting can solve such problems and give effective relaxation at the same time.**

HEAT SETTING 1



HEAT SETTING CONDITIONS

At **190 °C x 45''** **Recommended by Invista/DuPont**
180 °C x 1' **Typically used – but not enough**

Control “over feed” and width stretch to suit.

These conditions worry many processors because of :

- **Scorching and colour development.**
- **Difficulty in cleaning after burning in oils.**
- **Reduction in power of the fabric.**

Weft knitted fabrics

Stenter Presetting of circular knits requires slitting to open width with the disadvantage of curling of selvages in dyeing and a high risk of unlevelness. Options to overcome problem:

- ❑ Spot gumming of selvages with water-resistant resin**
- ❑ Edge sewing the fabric back into tubular form**
 - labour intensive, expensive, only high value fabrics**
- ❑ Use of air-flow type dyeing machines**
- ❑ New heat-setting machines for knitted fabric in tubular form, e.g. Dornier or Sperotto Rimar**

PROCESS OVERVIEW 1

Option 1 IDEAL

RELAXATION

**Solvent Scouring of synthetics,
or Steaming.**

HEAT SETTING

Over feed Stenter, 195 °C x 1'

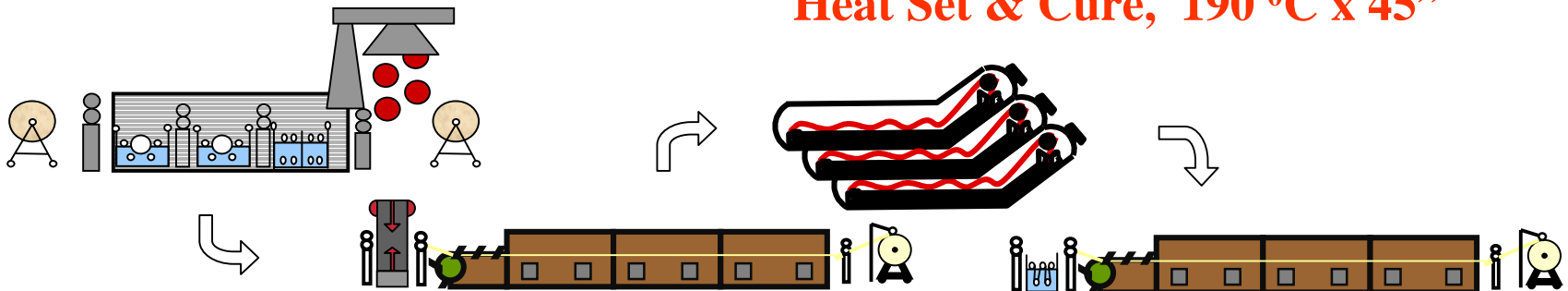
DYEING

May include pre-bleaching.

FINISHING

Pad finish then Dry.

Heat Set & Cure, 190 °C x 45''



If heat setting before dyeing is efficient, the setting required in finishing is less severe. This reduces yellowing in drying.

PROCESS OVERVIEW 2.1

Option 2 No Relaxation

HEAT SETTING

Over feed Stenter, 195 °C x 1'

Use Pre-relaxing Steam Frame if possible.

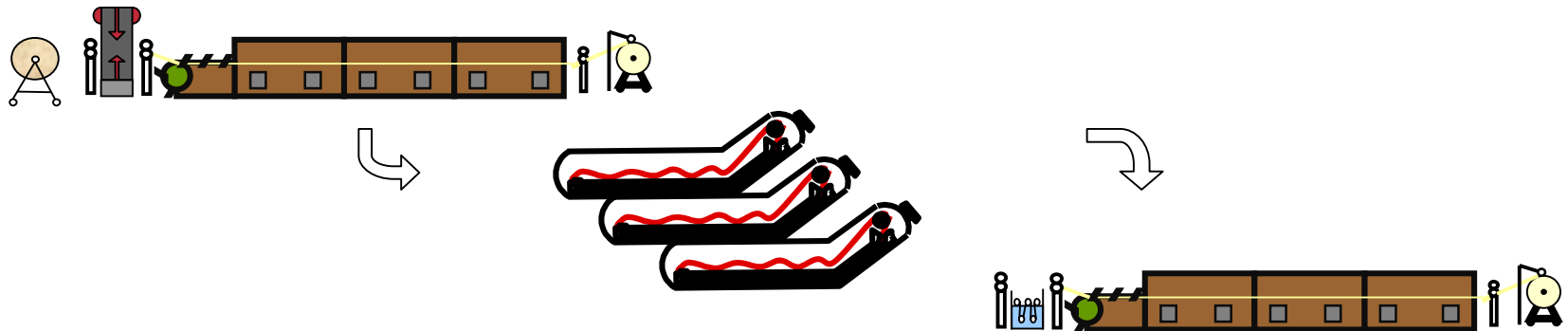
DYEING

May include pre-bleaching.

FINISHING

Pad finish then Dry.

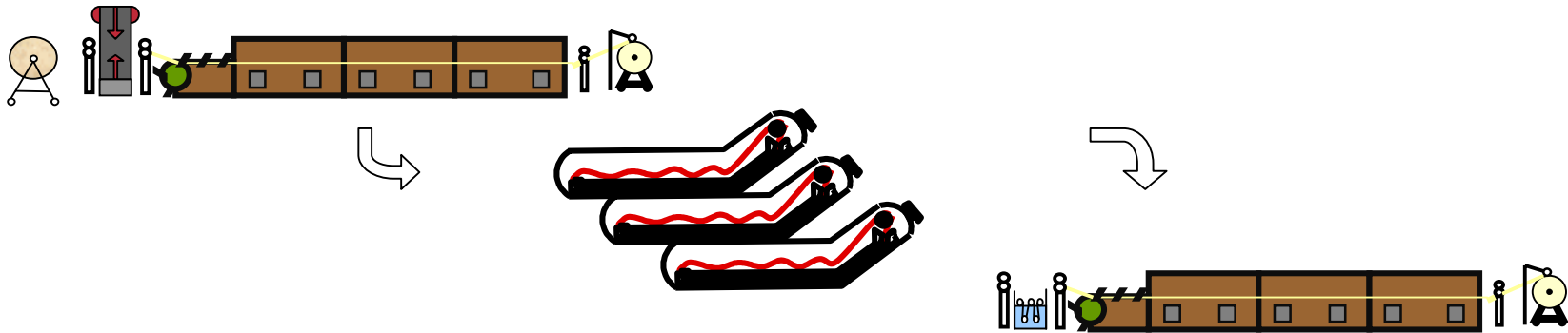
Heat Set & Cure, 190 °C x 45''



Cotton Elastane Tube Knits may need to be slit open for Heat Setting, and then blanket stitched back for dyeing.

PROCESS OVERVIEW 2.2

Notes on Option 2



Heat setting cotton at 195 °C causes scorching, and the setting of oils into the cotton.

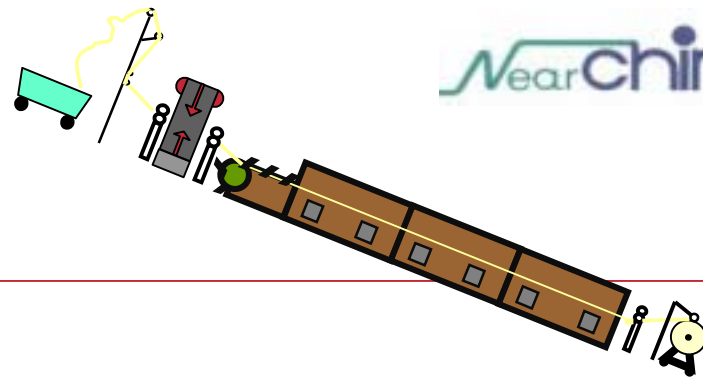
These are difficult to remove Silicone oils, Mg Stearate and un-emulsified mineral oil from knitting or weaving

PROCESS OVERVIEW 3

If it is possible to pad impregnate a suitable auxiliary before heat-setting

- **oils and lubricants can be more easily removed subsequently**
- **less risk of creasing in the dyeing machine**
- **use of anti-oxidant can avoid undue yellowing and scorching**
- **barré coverage of polyamide is improved - because amine end groups are undamaged**
- **correct heat setting temperatures can be used giving improved stability**

Heat-setting 2



NEARCAND LT 75

The Antiscorch.

A nylon substantive antioxidant.

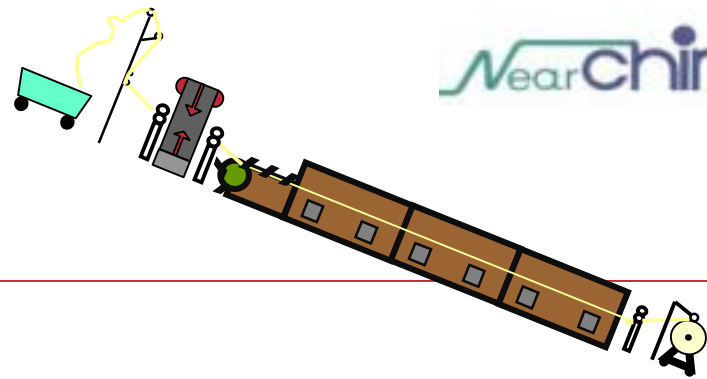
NEARCAND LT 75 adsorbs rapidly onto nylon to form an antioxidant film. This reduces the scorching of nylon and elastane polymers, gives improved coverage of barré in PA, and limits yellowing of softeners.

Used for Heat Setting, Finishing or Wet Bleaching of nylon and nylon blends.

Contains wetting agent/detergent and effective anionic oil emulsifier and anti-crease agent

Ideal for Heat Setting Polyamide/elastane blends.

Heat-setting 3



LUBRIFIL LAF

The problem solver.

An anionic multipurpose product.

Anionic emulsifier effective with oil and wax

Emulsifies and restrains oil from burning into cotton.

Cleans during scouring after heat set.

Disperses particles including dyes, dust and fibres.

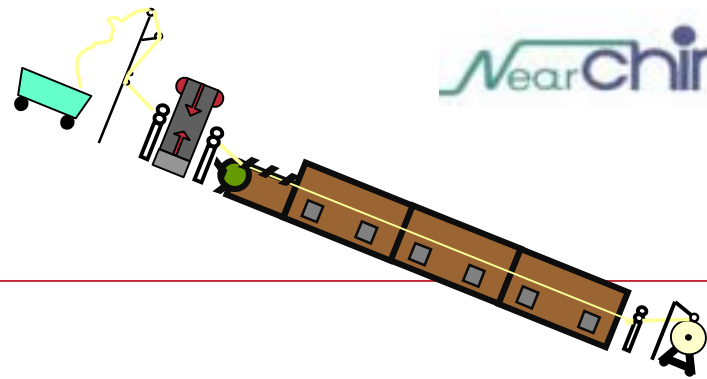
Anticrease

Lubricating effect helps to maximise the HSE. (Less return.)

Carries over into the dye bath and continues as an anticrease.

Ideal for Heat Setting Cellulose/ elastane and
Polyamide/ elastane blends

Heat-setting 4



NAISTAT 1350

The POLYESTER friend.

Hydrophilising agent

**By making the fibre surface more hydrophilic - less lipophilic scavenges and restrains oil from polyester and elastane.
Cleans during scouring, after heat set; prevents redeposition.**

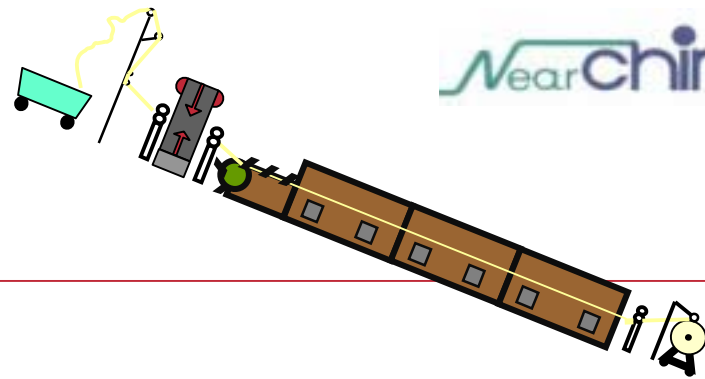
Anticrease

**Lubricating effect helps to maximise the heat setting efficiency
Carries over into the dye bath and continues as an anticrease.**

Helps reduce scorching of elastane by a protective film.

Ideal for Heat Setting Polyester/elastane blends.

Heat-setting 5



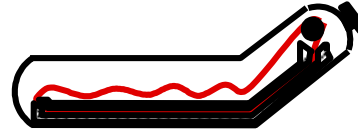
Some recipes.

	<u>CEL</u>	<u>Nylon</u>	<u>P'ester</u>	<u>PES/Cell</u>
NEARCAND LT 75	--	20 - 30 g/l	--	--
Wetting agent	--	1 - 2 g/l	--	--
NAISTAT 1350	--	--	10 - 20 g/l	10 - 20 g/l or
LUBRIFIL LAF	10 - 20 g/l	--	--	20 g/l

Maximum settling of fibres for optimum Heat Set, scorch protection, easier cleaning and trouble free dyeing.

=> Less distortion and better dyeing and finishing.

Scouring



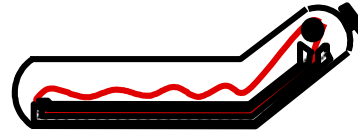
Nearpon KR NEW

- Developed for removing Silicone oils, ideal for elastane. Recommended by DuPont.
- Powerful environmentally-preferred Scouring Detergent for all difficult-to-remove oils.

Nearchel TMC or Nearchel 50 HP

- Powerful High Temperature sequestering agent (high complexing power for magnesium).
- Bleach Stabiliser, Cotton Protector and Whiteness Booster.

Scouring



Viscose/Lycra

There may be advantages in preparation of viscose/Lycra blends to use lower scouring/bleaching temperatures in order to avoid creasing and pin hole fabric damage.

Special bleach activators like NEARSTABIL 110 may be used to allow peroxide bleaching at 60 – 70° C.

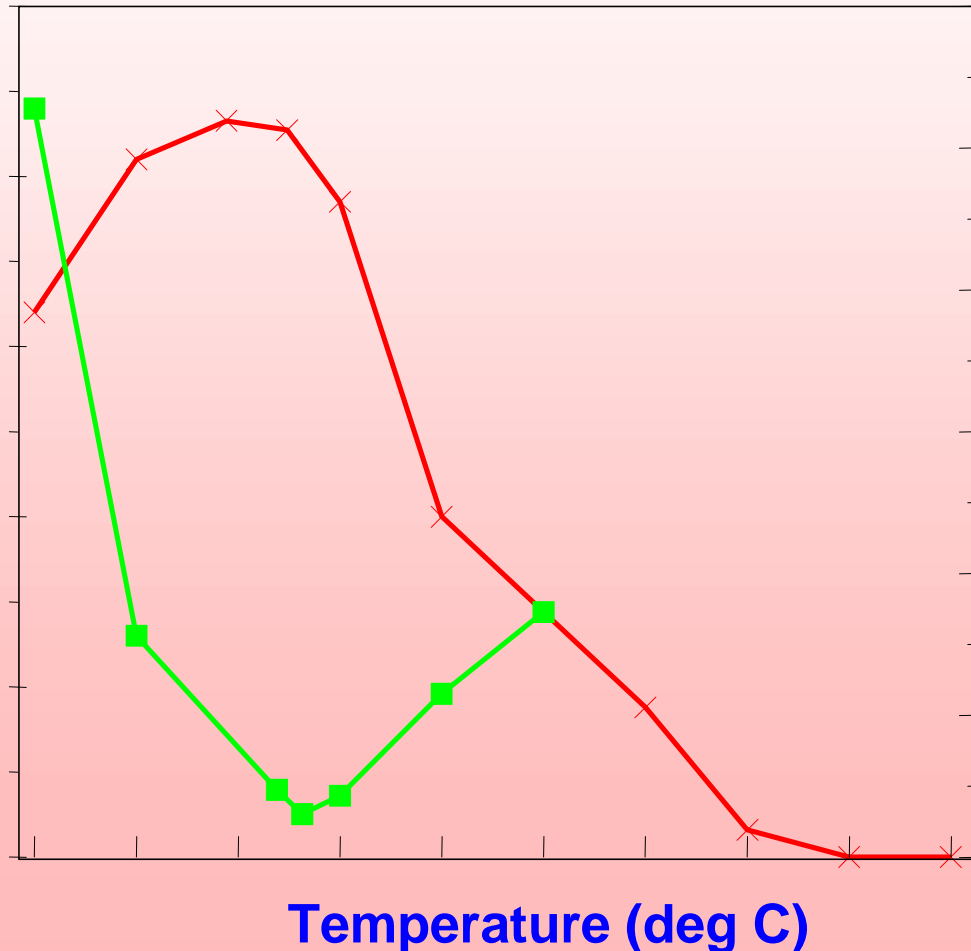
Nearpon KR NEW can be used equally successfully at such temperatures.

Nearchel TMC or 50 HP will help to avoid pin hole damage caused by heavy metal catalysis of hydrogen peroxide decomposition, and the low wet strength of viscose.

Detergency

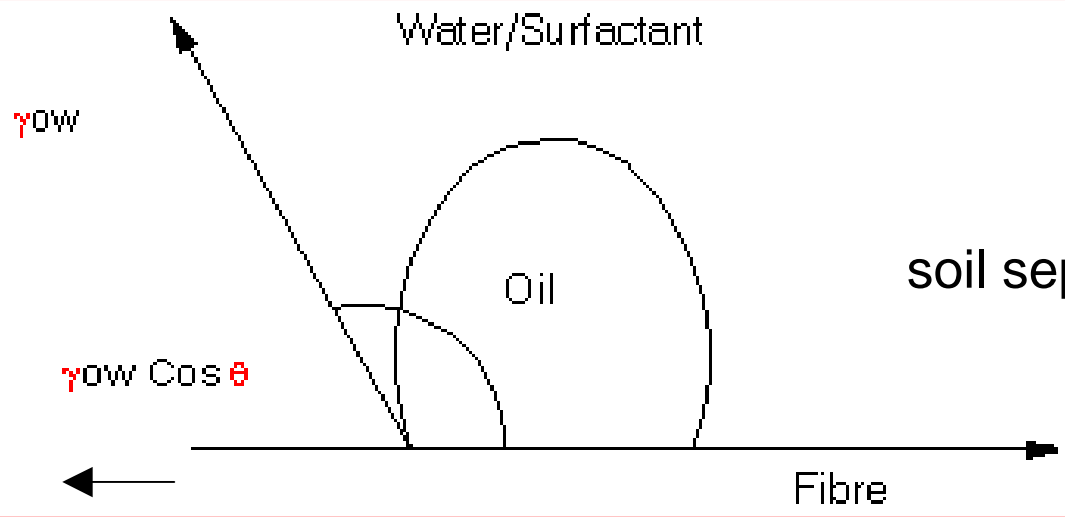
Effect of Temperature on Detergency and $\gamma_{o/w}$

Detergency
(= %age oil
removed)



$\gamma_{o/w}$
Oil/Water
Interfacial
Tension (mN/m)

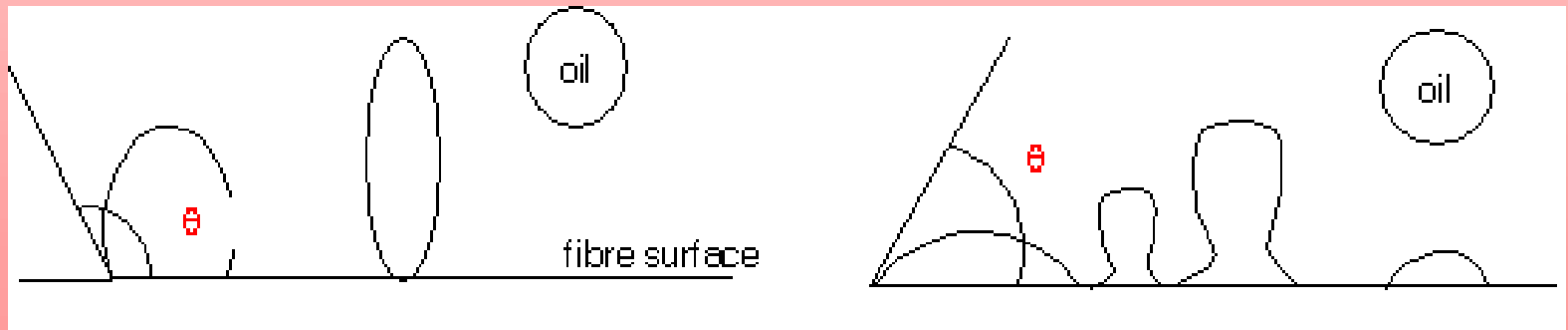
Oil and soil impurities on Fibre Surface



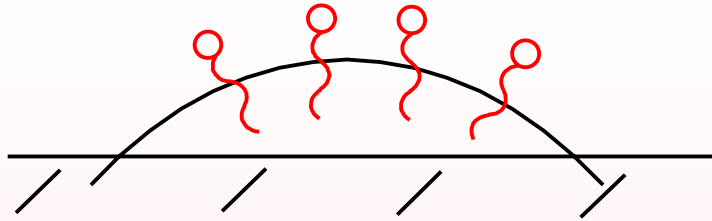
If $\theta > 90^\circ$

soil separates spontaneously

Roll-Back Mechanism



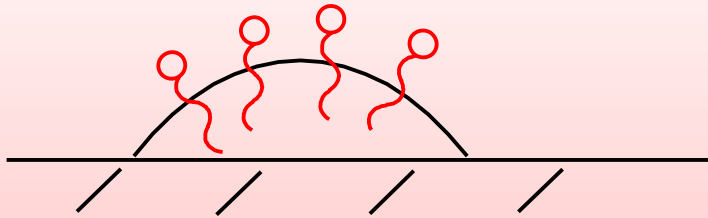
A)



SURFACE

SURFACTANT INCREASES OILY SOIL AFFINITY FOR WATER

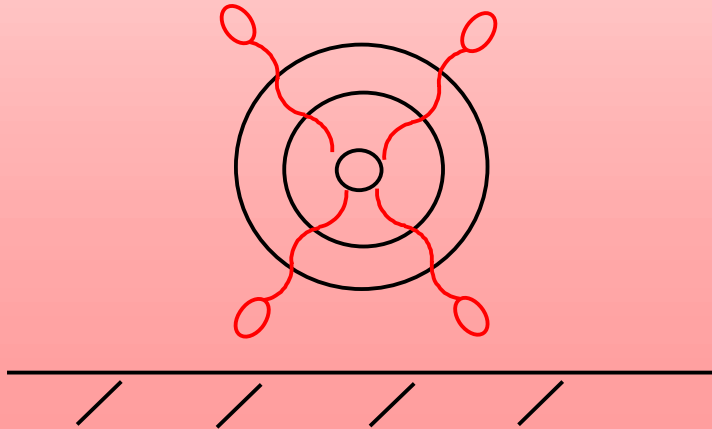
B)



SURFACE

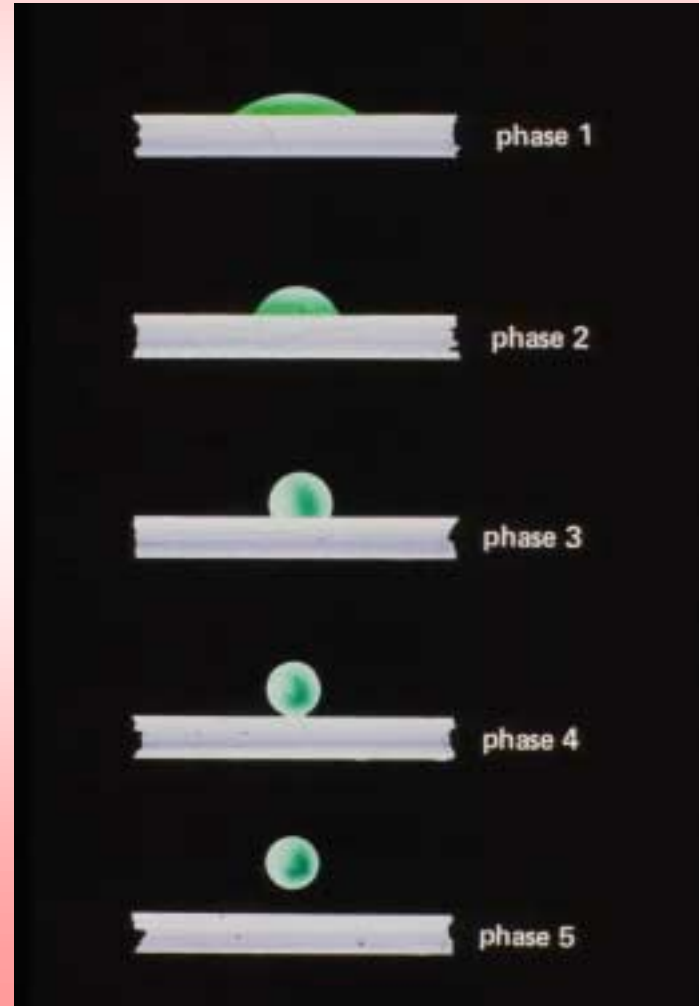
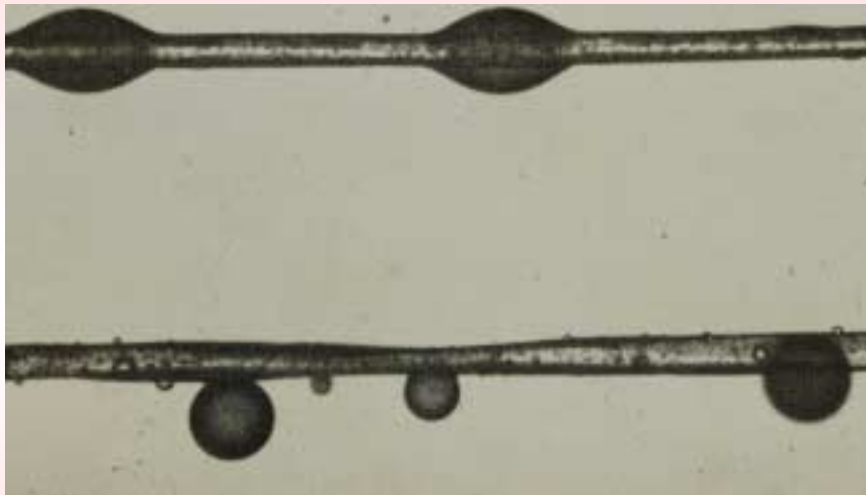
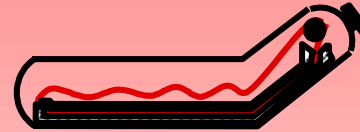
SOIL MOVES TO MAXIMISE SURFACE CONTACT WITH WATER

C)



SURFACE AREA MAXIMISED BY FORMING EMULSION DROPLETS

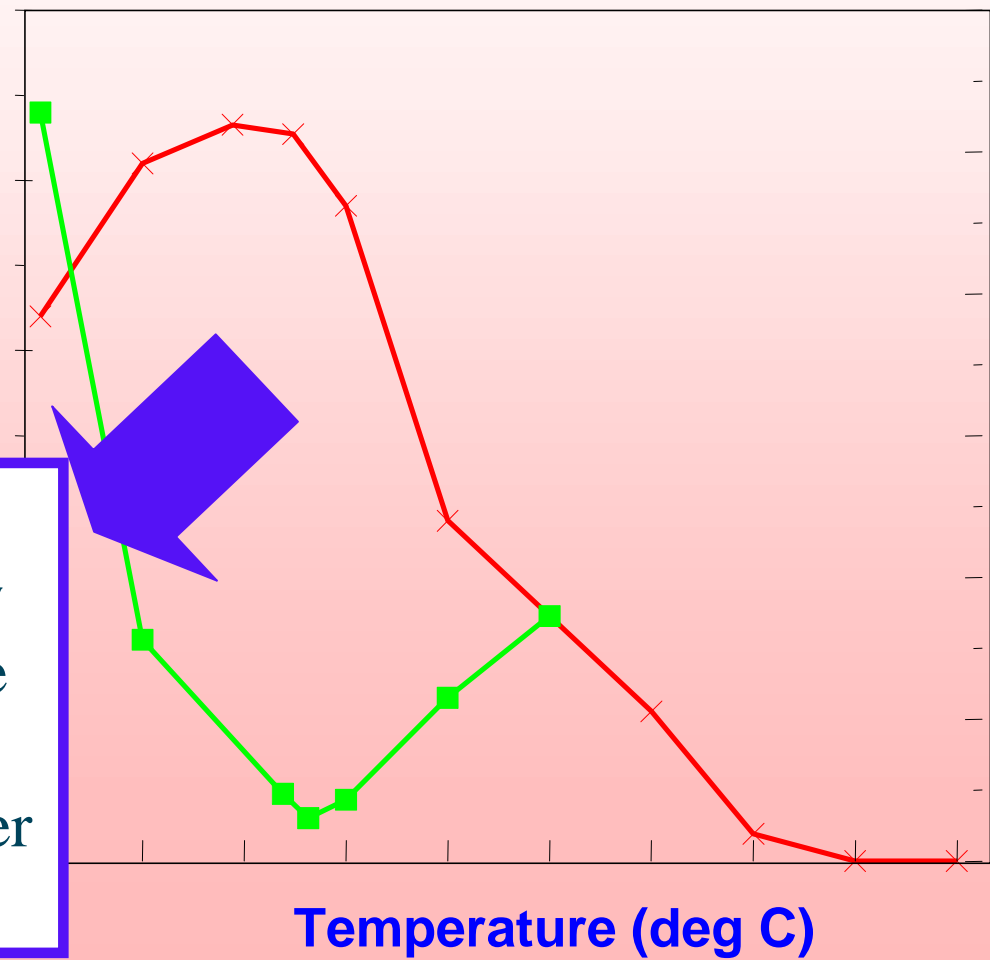
Scouring



Detergency

Effect of Temperature on Detergency and $\gamma_{o/w}$

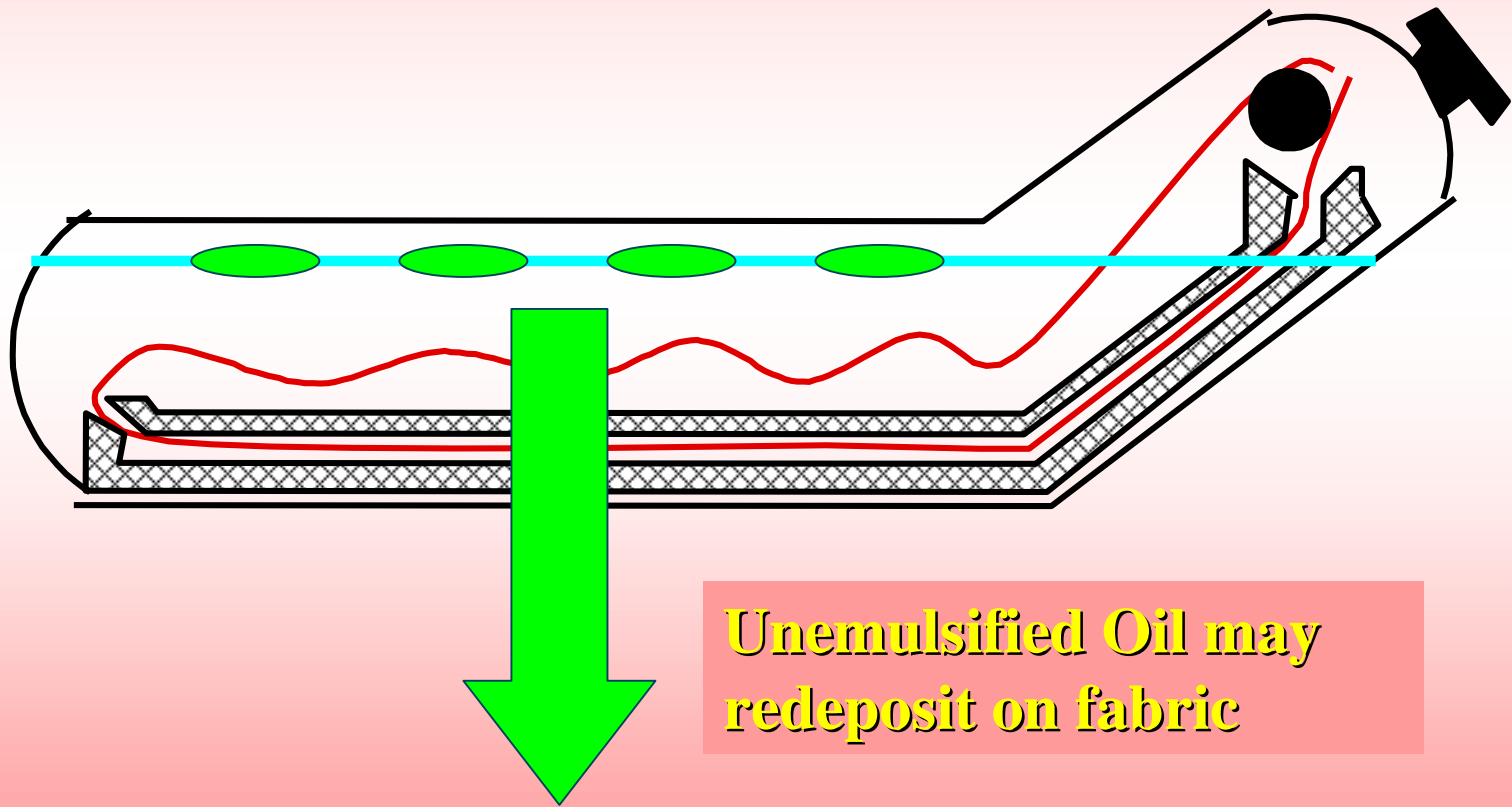
Detergency
(= %age oil
removed)



Cool down
or overflow
rinse before
draining to
ensure better
emulsion

$\gamma_{o/w}$
Oil/Water
Interfacial
Tension (mN/m)

Avoid redeposition



Unemulsified Oil may redeposit on fabric

PROCESS OVERVIEW 4

Option 3

No Heat Setting

Very Risky !

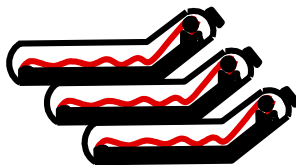
Not suitable for Knits.

Distortion, creasing and curling during dyeing are likely.

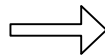
If a high temperature Heat Set is used in finishing to stabilise the fabric, scorching and softener yellowing are probable.

May be Suitable for

- polyester with low elastane content, say < 8%
- or fabric with very stable structure, such as heavy woven polyester .



Scour Relax and Dye



Pad Finish and Heat Set

195 C x 1'

PROCESS OVERVIEW 5

Option 4 The long process

RELAXATION

HEAT SETTING

DYEING

FINISHING

Scouring.

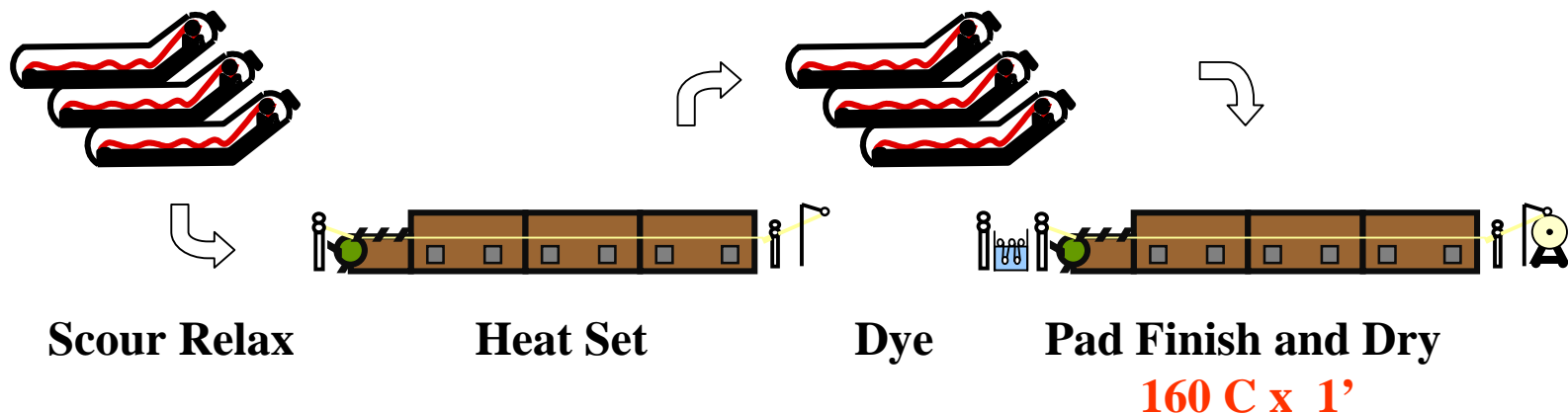
Over feed Stenter, 195 °C x 1'

May include pre-bleaching.

Pad finish then Dry.

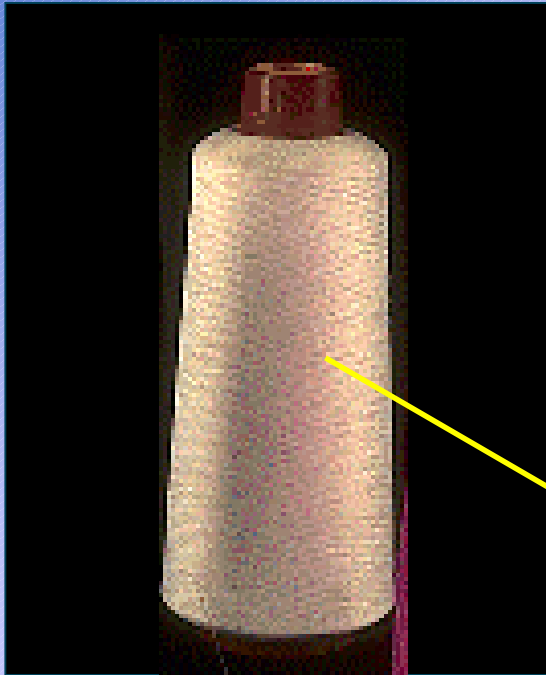
Heat Set & Cure, 160 °C x 45''

Suitable for high value, delicate or sensitive fabrics.

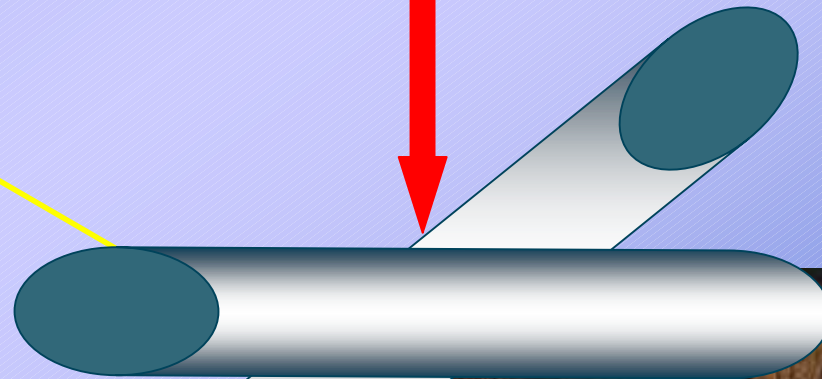


Elastane fibre finish

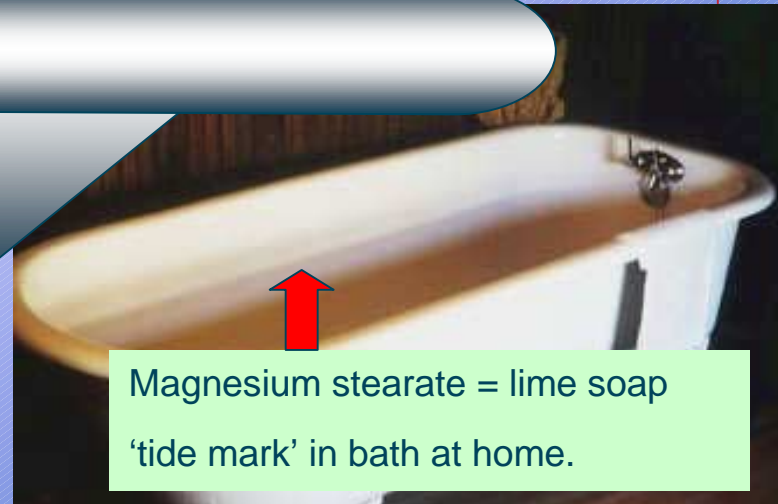
100% elastane yarn on bobbin



Silicone oil and magnesium stearate applied to prevent sticking together at cross-over points

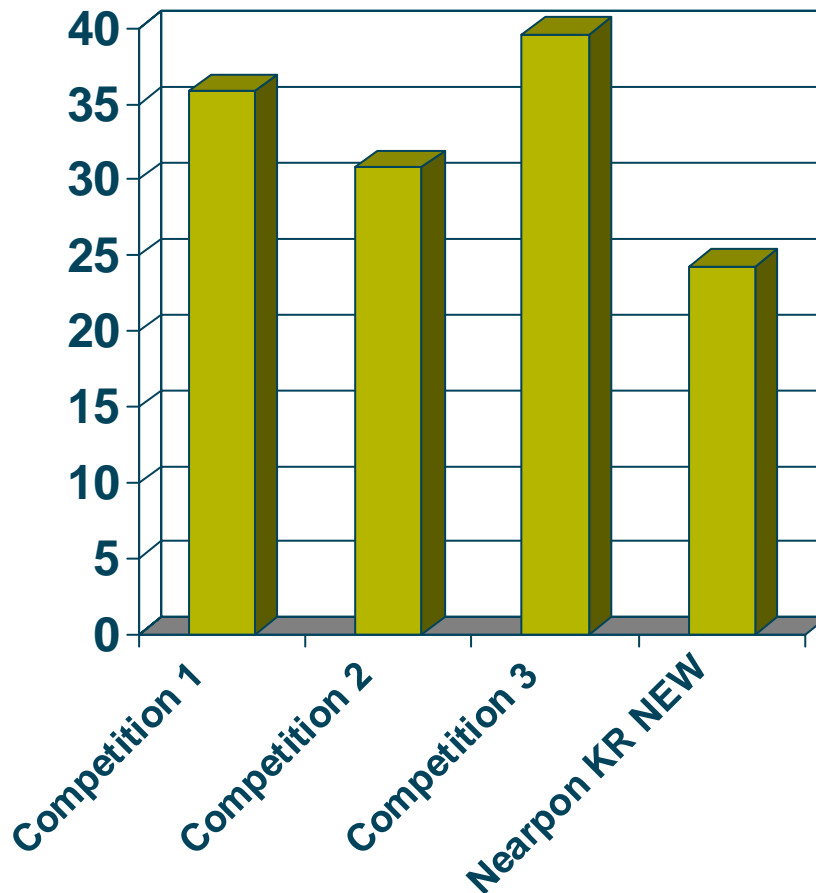


NEARPON KR NEW is recommended to remove silicone oil, **NEACHEL TMC** or **NEARCHEL 50 HP**, recommended to remove magnesium silicate.



Magnesium stearate = lime soap
'tide mark' in bath at home.

% silicone determined by XRF remaining in PA/Lycra warp knit fabric after scour



Quantity of silicone before scour expressed as 100%

■ Scoured with 1 g/l detergent

XRF = X-Ray fluorescence

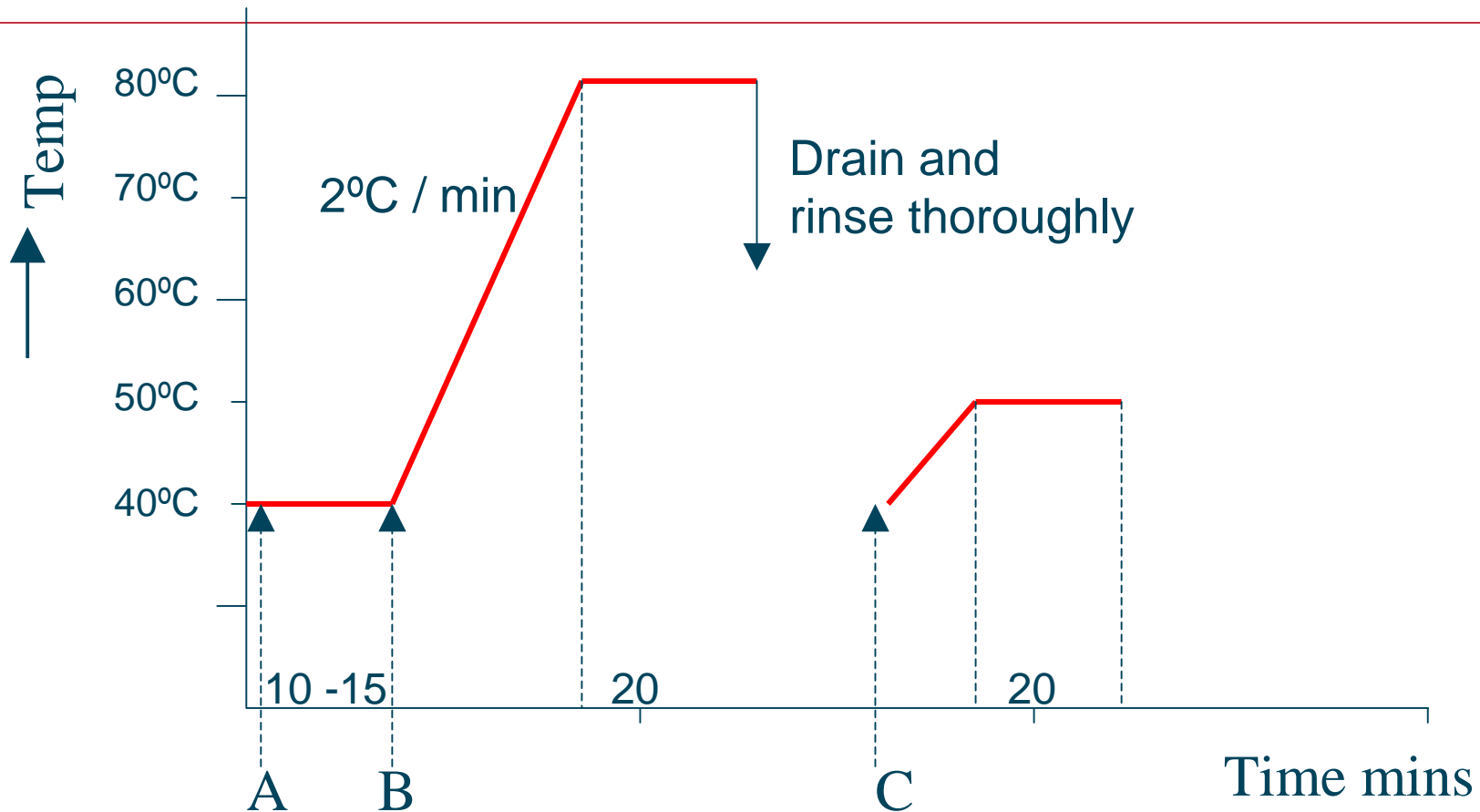
Fastness Improvement

Anionic/cationic aftertreatment

The wet fastness achieved on Polyamide/elastane blends is usually lower than on 100% polyamide because the dyes used for polyamide stain the elastane, and this stain subsequently washes out in fastness testing

Since 1993 Nearchimica have been promoting a process for improving wet fastness on polyamide, especially microfibre polyamide in deep shades. The process involves first aftertreatment with anionic fixing agent, **Nearfix APS**, thorough rinsing, and then further aftertreatment with cationic fixing agent, **Nearfix NWL**. Aftertreatment with **Nearfix NWL** can also be applied together with a suitable softener in an exhaust or final pad application before drying on the stenter.

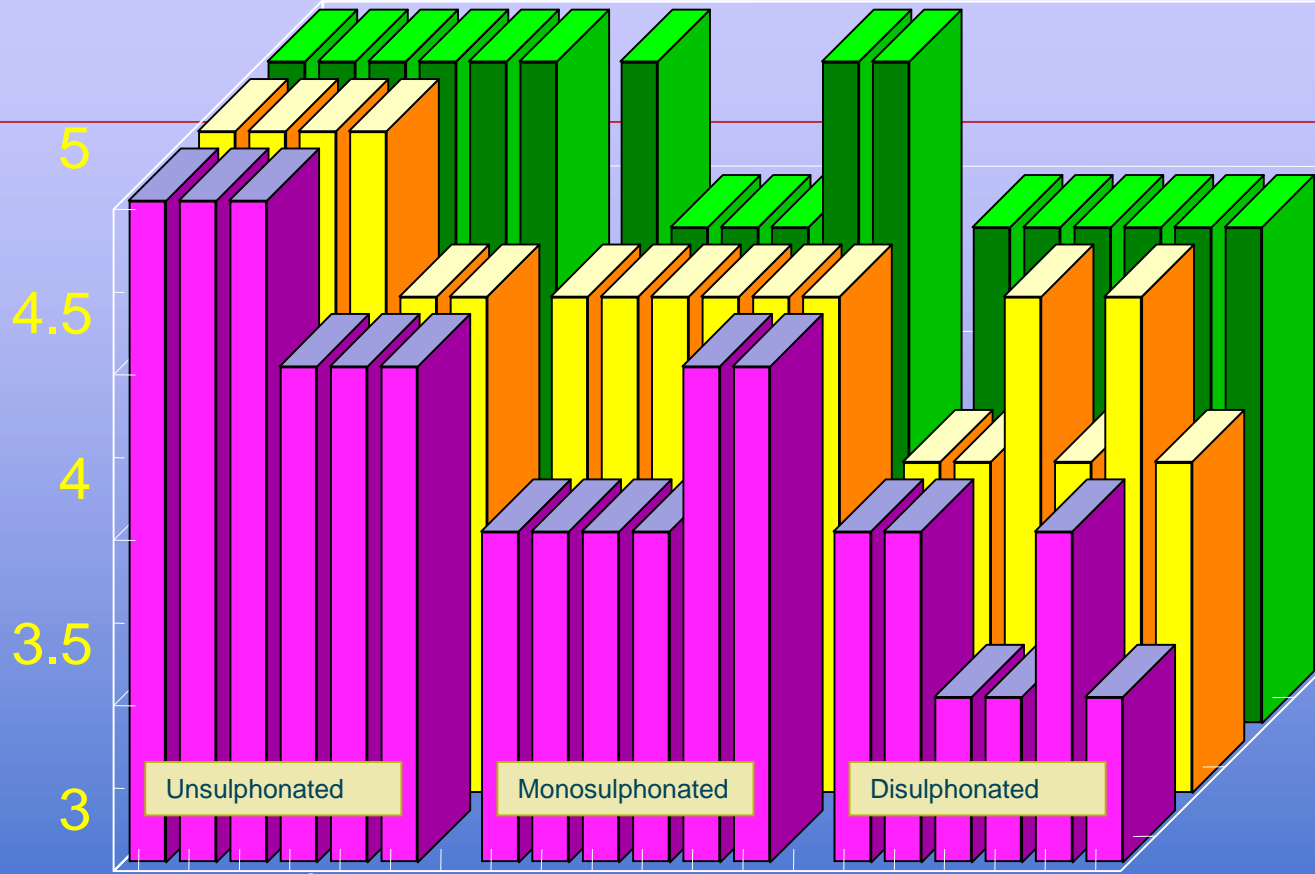
Double aftertreatment process



A = 2 - 3 % **Nearfix APS**
B = x% dilute acetic acid or
acid donor to give final pH 4 - 4.5

C = 2 - 3 % **Nearfix NWL**

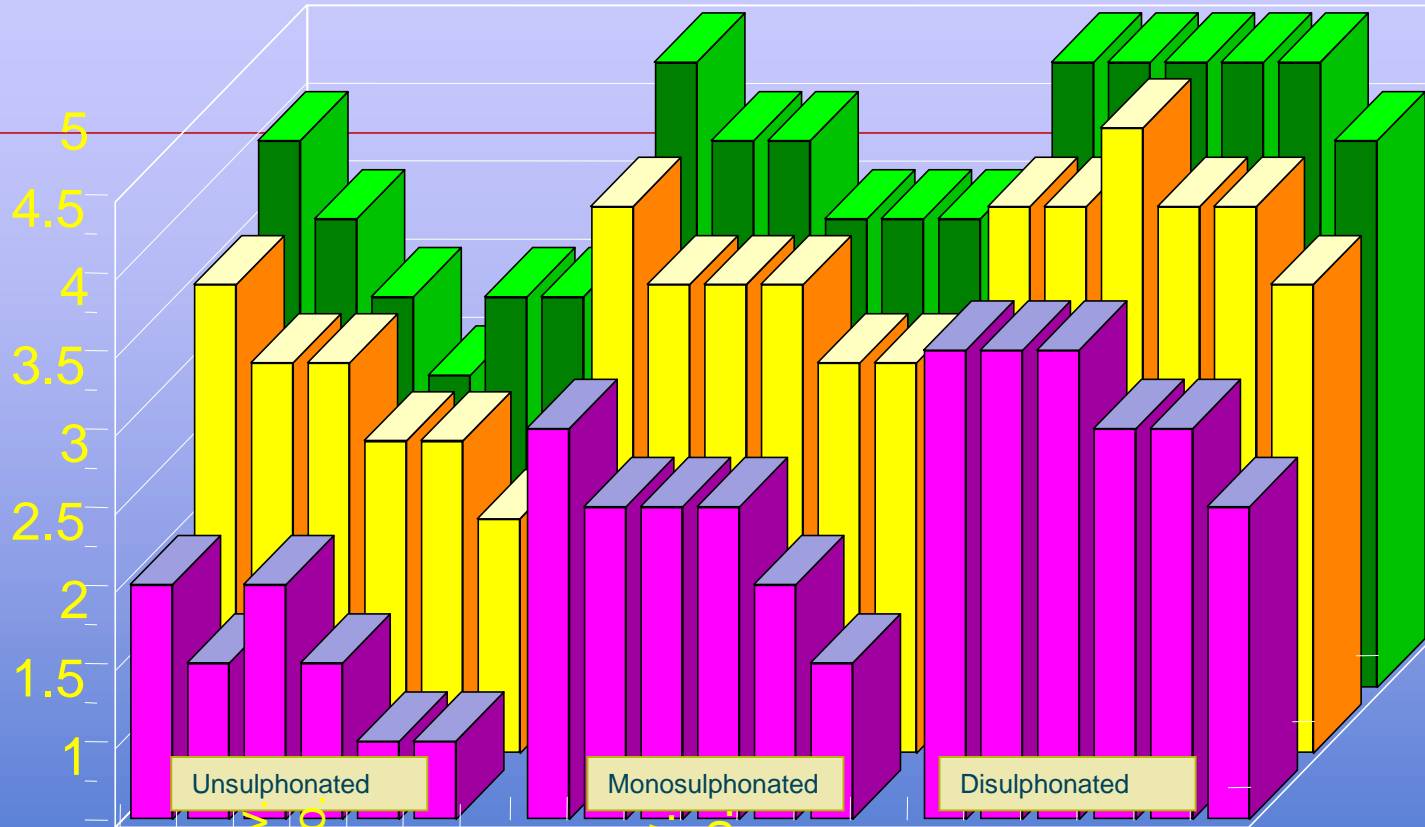
Shade change assessment of dyed, treated, conventional and microfibre nylon 6.6



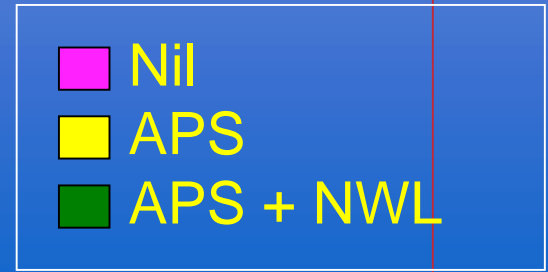
Yellow 137 Conv.
 Yellow 137 Micro.
 Acid Red 182 Conv.
 Acid Red 182 Micro.
 Black 107 Conv.
 Black 107 Micro.
 Orange 144 Conv.
 Orange 144 Micro.
 Rubine S-2R Conv.
 Rubine S-2R Micro.
 Blue 284 Conv.
 Blue 284 Micro.
 Violet 90 Conv.
 Violet 90 Micro.
 Blue 193 Conv.
 Blue 193 Micro.
 Black 194 Conv.
 Black 194 Micro

■ NiI
■ APS
■ APS + NWL

Staining of adjacent nylon 6.6 of dyed, treated conventional and microfibre polyamide 6.6



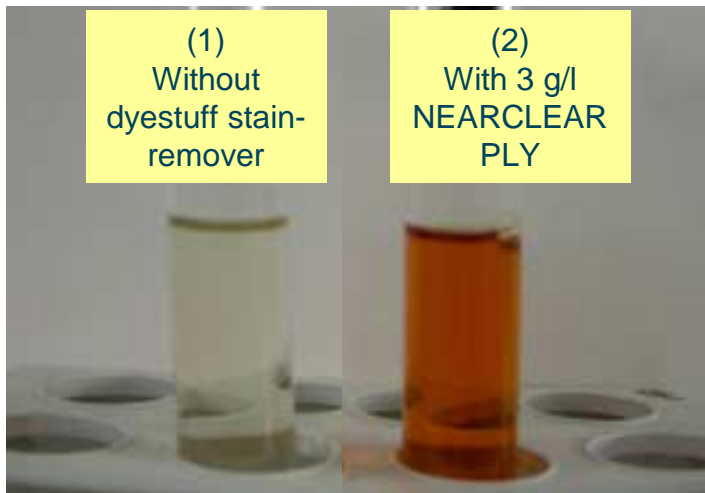
Yellow 137 Conv.
 Yellow 137 Micro.
 Acid Red 182 Conv.
 Acid Red 182 Micro.
 Black 107 Conv.
 Black 107 Micro.
 Orange 144 Conv.
 Orange 144 Micro.
 Rubine S-2R Conv.
 Rubine S-2R Micro.
 Blue 284 Conv.
 Blue 284 Micro.
 Violet 90 Conv.
 Violet 90 Micro.
 Blue 193 Conv.
 Blue 193 Micro.
 Black 194 Conv.
 Black 194 Micro.



Polyester/elastane blends

- ❑ We need to find a compromise between fastness and loss of elasticity.
- ❑ Disperse dyes need high temperatures to achieve adequate build-up on polyester, but elasticity of elastane is reduced at temperatures above 115°C.
- ❑ Disperse dyes stain elastane heavily and have very low wet fastness on elastane. To improve fastness use dyes:
 - with high fastness on polyester
 - with good build-up on PES at low temperatures
 - with easy clearing properties

Polyester / elastane - efficient clearing



**MORE UNFIXED DYE
REMOVED WITH NEARCLEAR PLY**

Practically all disperse dyes stain elastane heavily. Efficient reduction clearing after dyeing is essential to achieve satisfactory wet fastness.

For good clearing of disperse dyes from elastane, temperatures of 80° - 90° C are necessary, and an effective wash-off and dispersing agent, e.g. **Nearclear PLY**, should be used to extract the disperse dye from the elastane. At these temperatures sodium hydrosulphite reacts too fast and is therefore not efficient. The more stable **Riducente FBT** should be used

3 % caustic soda 36° Bé
2 - 4 % Riducente FBT
3 % Nearclear PLY
for 30 minutes at 85° C

Dyeing Cellulose / elastane blends

- Use **Lubrifil LAF** in pre-padding before heat setting to help in subsequent removal of oils
- Pay particular attention to uniform yield (g/m^2) on stenter, especially with viscose / elastane - use a stenter with support band if possible.
- Side-to-centre-to-side shade variation and piece to piece shade variation is a particular problem. To overcome :
 - use Migration techniques - dye at higher temperature before alkali addition because high elasticity and curling selvages make level dyeing difficult
 - use **Neargal LU-SRV** to improve shade consistency
 - use **Nearoxidol PL** to prevent destruction of dyes sensitive to reducing conditions created by higher dyeing temperatures, especially with viscose, and thus improve reproducibility.
 - buffer dyebath with 0.3 - 2.0 g/l monosodium phosphate to avoid bicarbonate in water initiating premature reaction.