



# Ingeo™ Fibre Apparel Product Guidelines

## Dyeing and Finishing

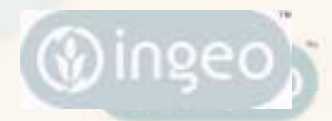
### Contents:

1. Introduction to Ingeo™ fibre
2. General considerations for dye and finish
3. Dye selection
4. Shades and washing fastness
5. Dye cycles
  - 100% Ingeo™ fibre
  - Ingeo™ fibre / cotton
  - Ingeo™ fibre / wool
  - Package dye
6. Process routes
7. Atmospheric dyeing

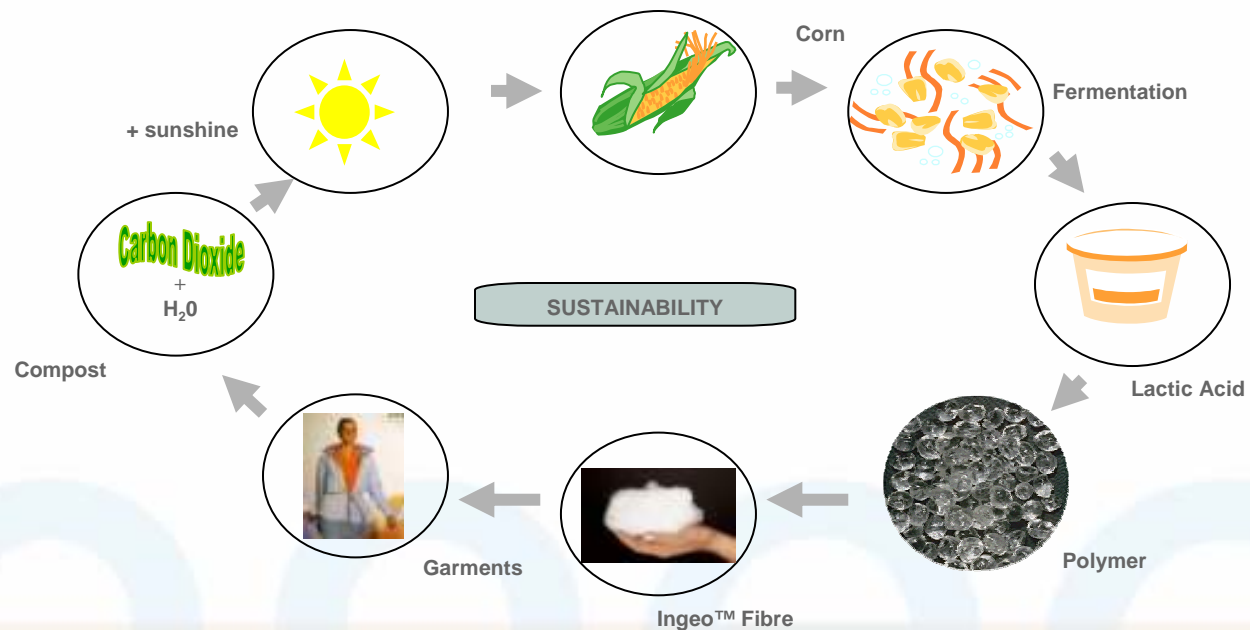


# Apparel Product Guidelines

## 1. Introduction to Ingeo™ fibres



- The only synthetic fibre commercially available in bulk quantities, that is made entirely from annually renewable raw materials - not oil



Not only from nature - but also back to nature



## From nature, and back to nature - plus performance:

- **Excellent wicking properties**
  - **Moisture management**
  - **Low odor retention**
  - **Does not support bacterial growth**
  - **Hypoallergenic**
  - **Rapid soil release**
  - **Quick drying**
  - **Excellent after wash appearance**
- ⇒ Comfort
- ⇒ Fresh
- ⇒ No skin irritation
- ⇒ Easy care

And all supported by detailed technical bulletins .....

..... selected technical bulletins

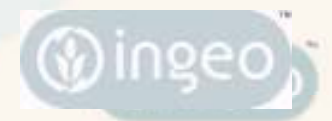
Subject	Bulletin number
<b>Apparel</b>	
Odour release	290904
Hohenstein Institute testing	260904
Washing and dry cleaning performance	50904
Fibre & fabric properties	180904
<b>Home textiles</b>	
Fibre fill compression testing	200904
Duvet / comforter performance	130904
Pillow performance	320904
Furnishing flammability characteristics	110104
<b>Non woven</b>	
Moisture transport in Ingeo™ fibre non woven fabrics	380904
Wipes regularity technical bulletin (toxicology)	390904
Wipes commercial production information	110804
<b>Multi product</b>	
Compostability	120904
Ingeo™ fibre fabric UV resistance	370904

These and more available on [www.ingeofibers.com](http://www.ingeofibers.com)



# Apparel Product Guidelines

## 2. Dyeing - general considerations



## General considerations:

### 1) Lower melt point (170°C)

- Safe, effective, heat setting – 130°C for 30sec
- No high temperature heat set for blends with:
  - Nylon, PET
  - Elastane (~3% with no heat set OK)

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## General considerations:

### 2) Sensitivity to high temperature and alkali conditions:

- Safe, effective dyeing - 110°C for up to 30min
- Safe, effective processes developed:
  - Scour
  - Reduction clear
  - Reactive dye
  - Cotton pre bleach
  - etc



### General considerations:

### 3) disperse dyes behave differently from PET on Ingeo™ fibre :

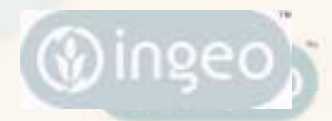
- Not all dyes good for PET are good for Ingeo™ fibre
  - Different exhaustion (some correlation with acetate dyeing)
- Dye shades are different on Ingeo™ fibre compare with PET:
  - Brighter than on PET
  - Higher visual colour yield than PET

**DYE SELECTION FOR INGEO™ FIBRE DYEING IS ESSENTIAL**



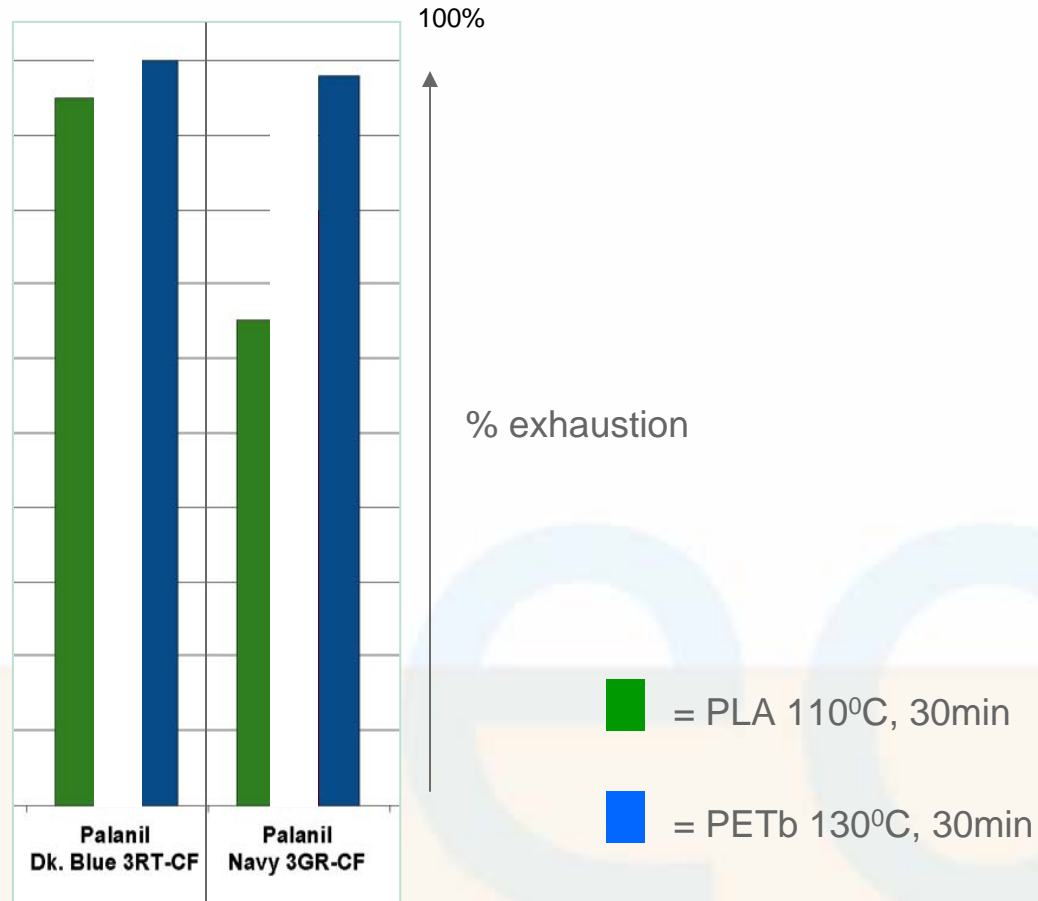
# Apparel Product Guidelines

## 3. Dye selection

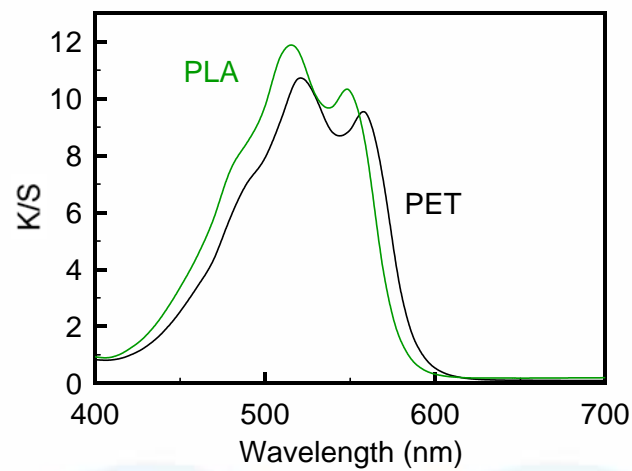
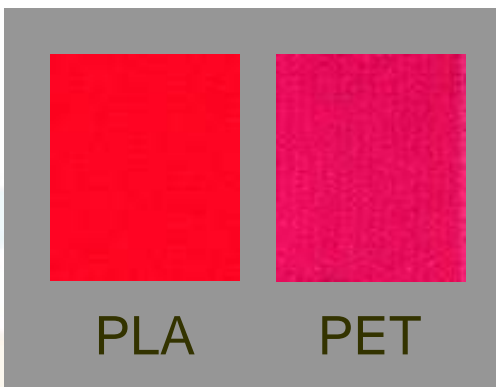
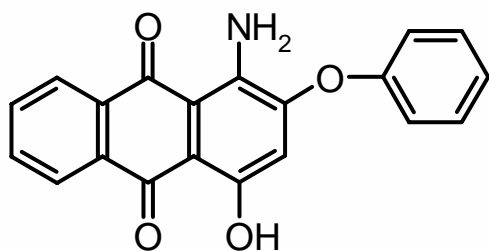




## Different dyes – different exhaustion



Same dye – different shade










## Selected dyestuff for high wash fastness - DyStar

### Ternaries

-  Dianix Flavine XF
-  Dianix Yellow Brown XF
-  Dianix Deep Red SF
-  Dianix Blue XF

### Support dyes





-  Dianix Scarlet XF
-  Dianix Rubine XFN
-  Dianix Turquoise XF
-  Dianix Navy XF
-  Dianix Black XF

## Selected dyestuff for high light fastness - DyStar

### Ternaries

-  Dianix Orange AM-SLR
-  Dianix Red AM-SLR
-  Dianix Blue AM-SLR
  
-  Dianix Yellow AM-42
-  Dianix Dark Red AM-2B
-  Dianix Blue AM-77

### Support dyes

-  Dianix Yellow AM-G
-  Dianix Turquoise S-BG
-  Dianix Navy AM-G
-  Dianix Black AM-B

## Selected dyestuff for standard fastness - DyStar

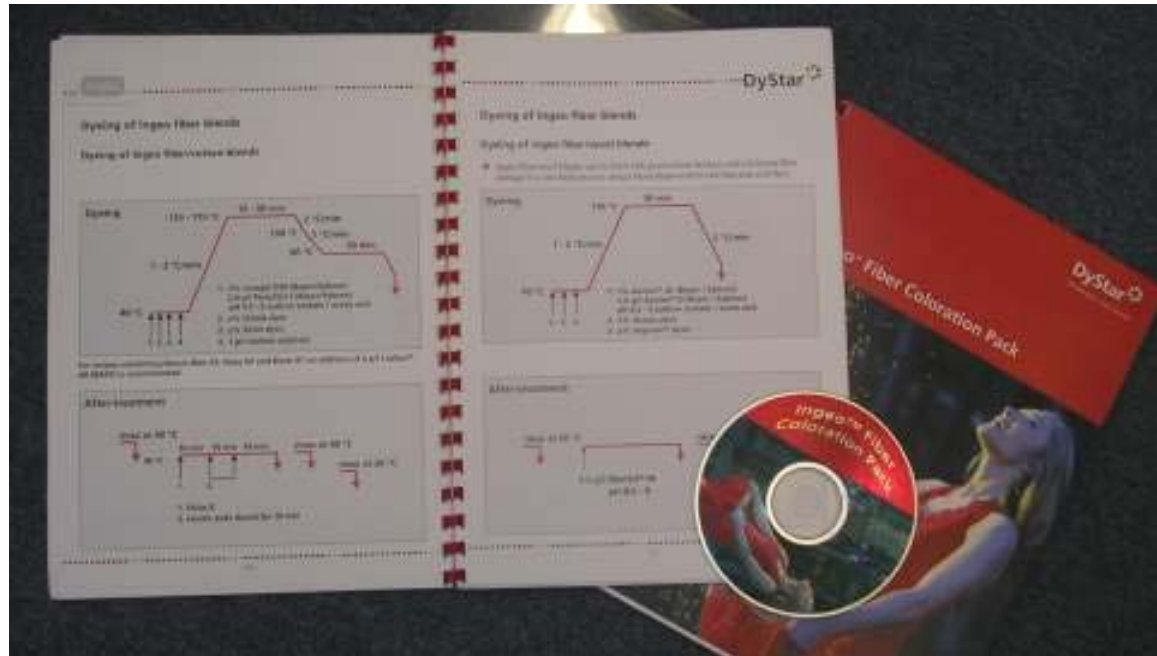
### Ternaries

-  Dianix Yellow AC-E new
-  Dianix Red AC-E 01
-  Dianix Blue AC-E
  
-  Dianix Yellow Brown CC
-  Dianix Rubine C-B 150%
-  Dianix Blue K-FBL

### Support dyes

-  Dianix Flavine XF
-  Dianix Red C-4G 150%
-  Dianix Violet S-4R
-  Dianix Dark Blue SE-3RT
-  Dianix Turquoise S-BG

# DyStar Colouration Package



**Comprehensive processing suggestions from DyStar**

**CD ROM with Colour matching data base**

TM

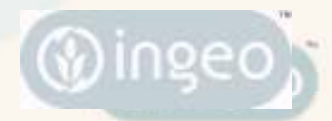






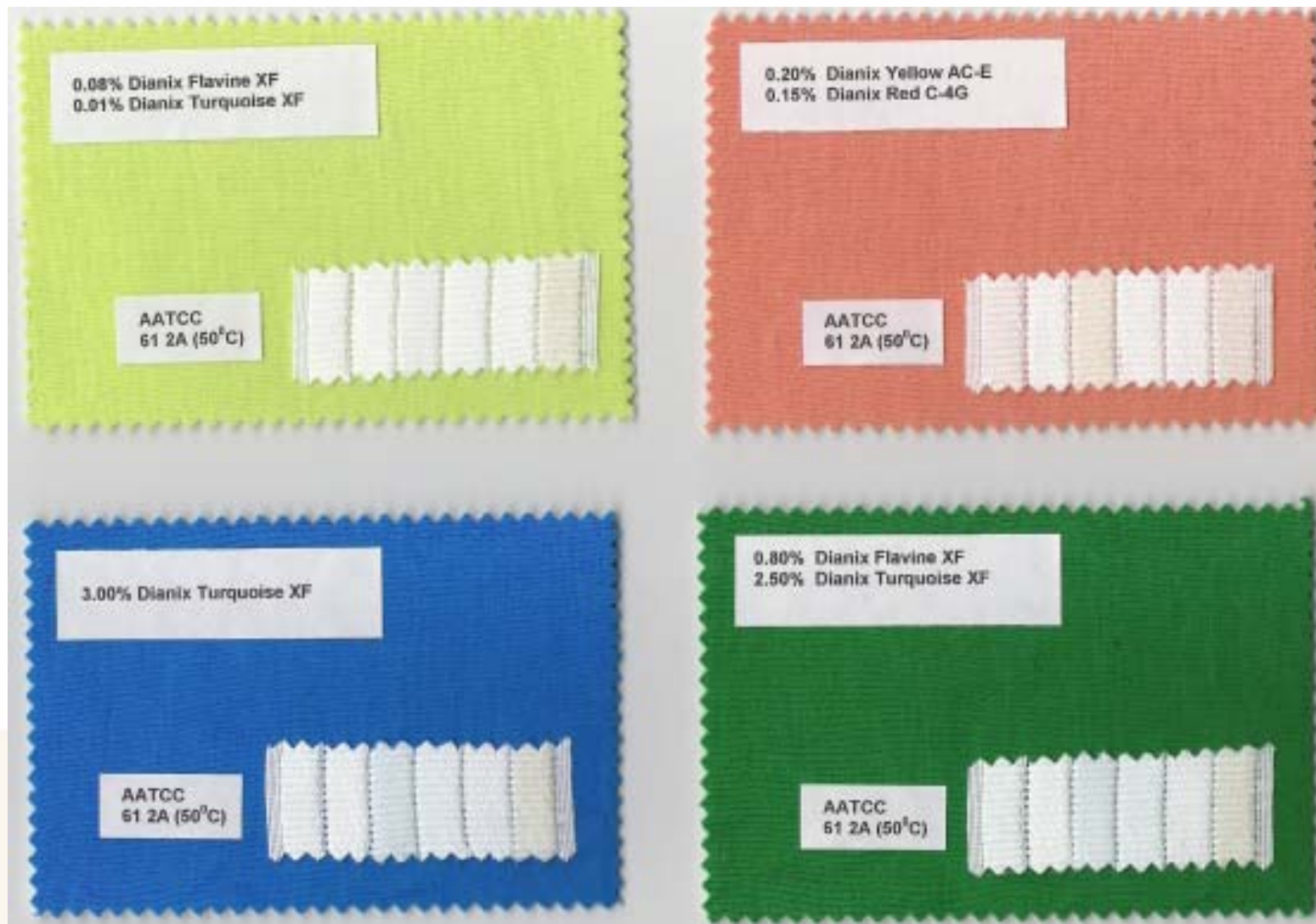
# Apparel Product Guidelines

## 4. Shades and washing fastness



## Shades and fastness

### AATCC 2A (50°C) fastness on pale / medium shades



## Shades and fastness

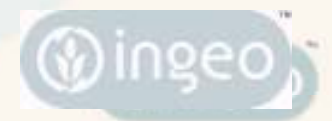
### AATCC 1A (40°C) fastness on medium / dark shades





# Apparel Product Guidelines

## 5. Process routes



### Typical Route

Scour / Dye / (Reduction clear)



Hydro



Relax dry



Slit



Pad soften

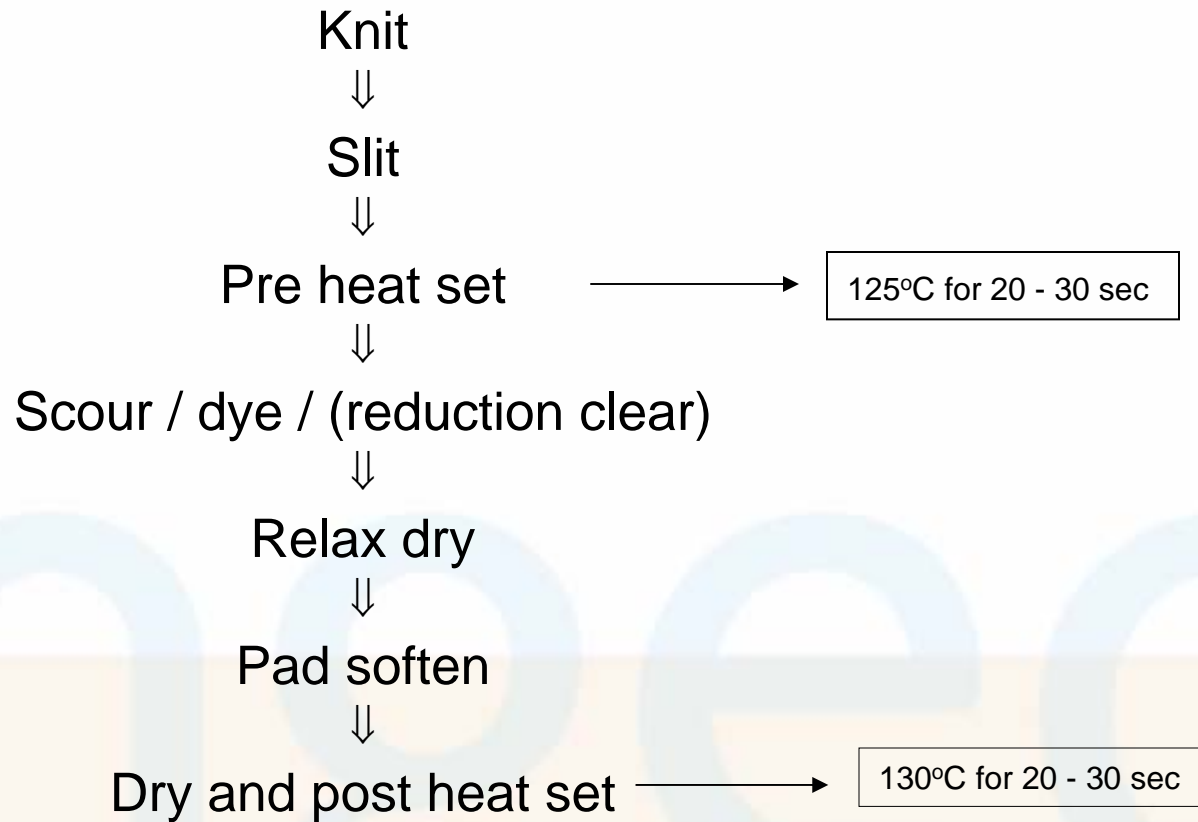


Stenter dry / heat set



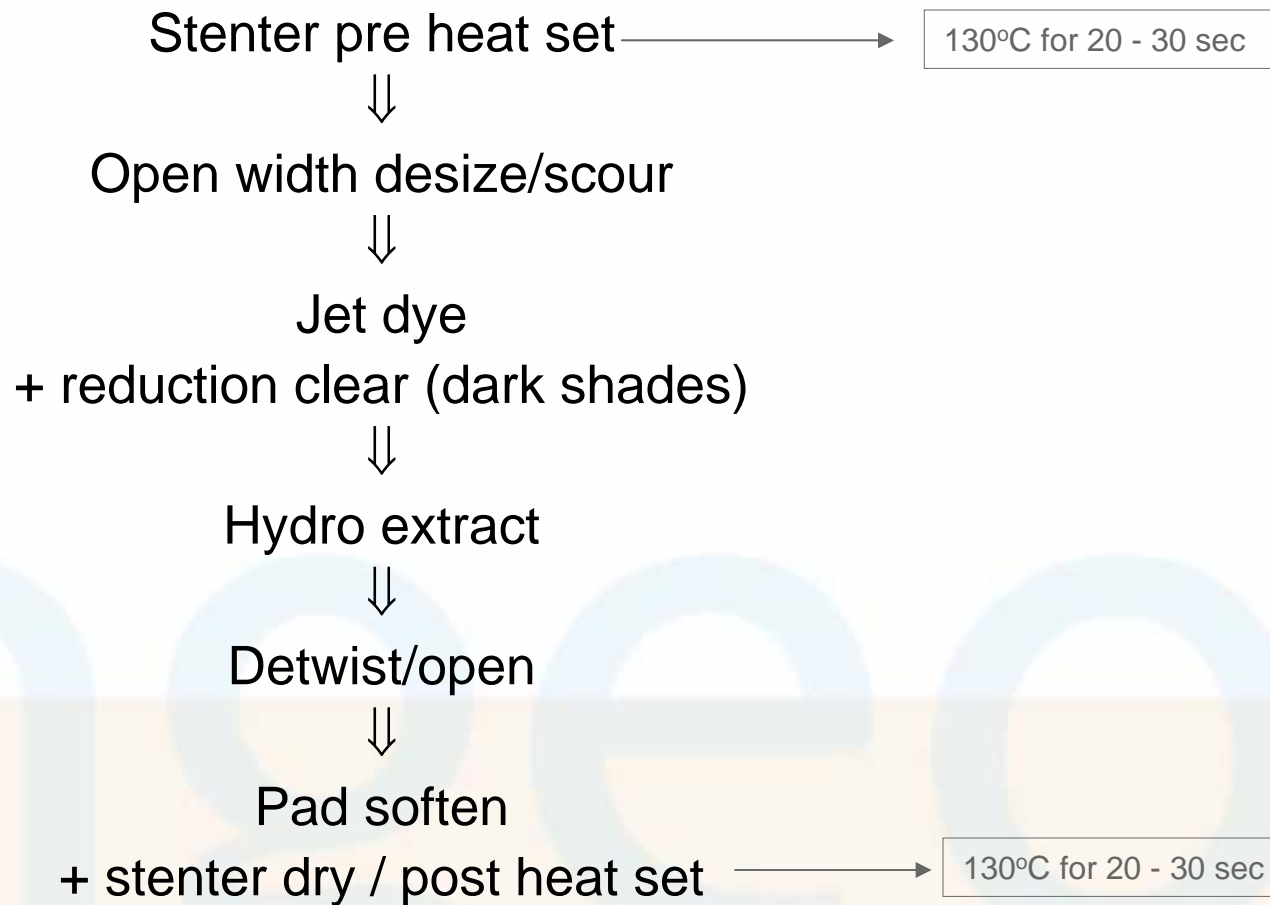
130°C for 20 - 30sec

## Typical Route



# Ingeo™ fibre woven fabric dyeing

- Many variations in woven fabrics finishing routes
- Suggested routing for trial start point only:

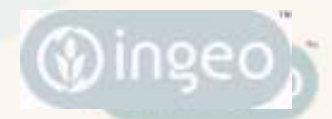




# Apparel Product Guidelines

## 6. Dye cycles

- **100% Ingeo™ fibre**
- Ingeo™ fibre / cotton
- Ingeo™ fibre / wool
- Package dye



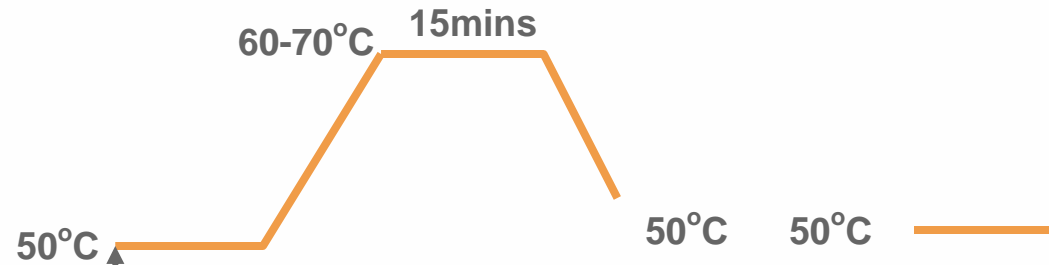




# Ingeo™ fibre dyeing and finishing - Dye cycles

100% Ingeo™ fibre

Scour



1 g/l Kieralon MFB (BASF)  
1 g/l Na<sub>2</sub>CO<sub>3</sub>

TM

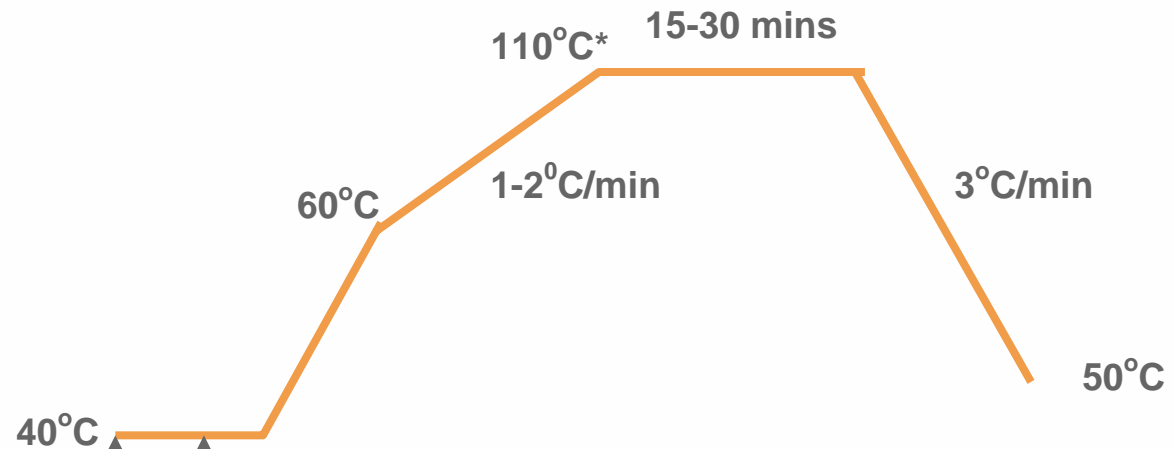




# Ingeo™ fibre dyeing and finishing - Dye cycles

100% Ingeo™ fibre

Dye



1 g/l Levegal DLP (Bayer)  
Acetic acid/ sodium acetate to pH 4-5

Dianix dyes

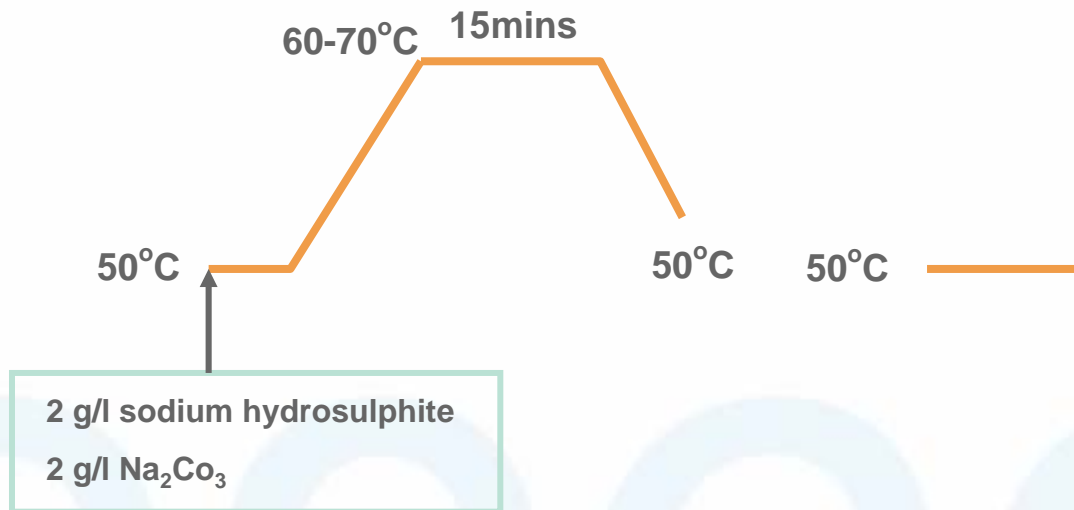
\* Very heavy shades may be dyed for 30min at 115°C for maximum colour yield



## Ingeo™ fibre dyeing and finishing - Dye cycles

100% Ingeo™ fibre

Reduction Clear (dark shades)

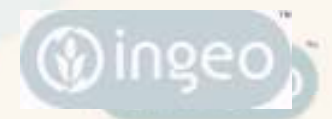




# Apparel Product Guidelines

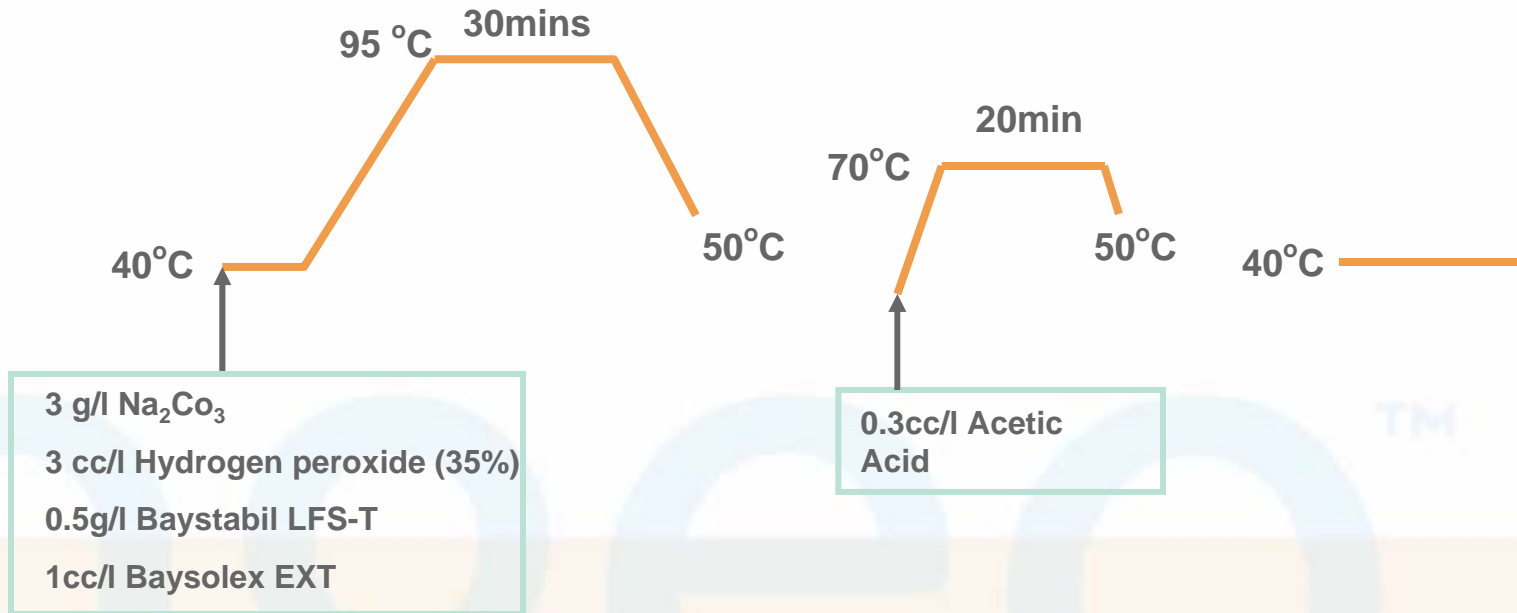
## 6. Dye cycles

- 100% Ingeo™ fibre
- **Ingeo™ fibre / cotton**
- Ingeo™ fibre / wool
- Package dye



# Ingeo™ fibre dyeing and finishing - Dye cycles

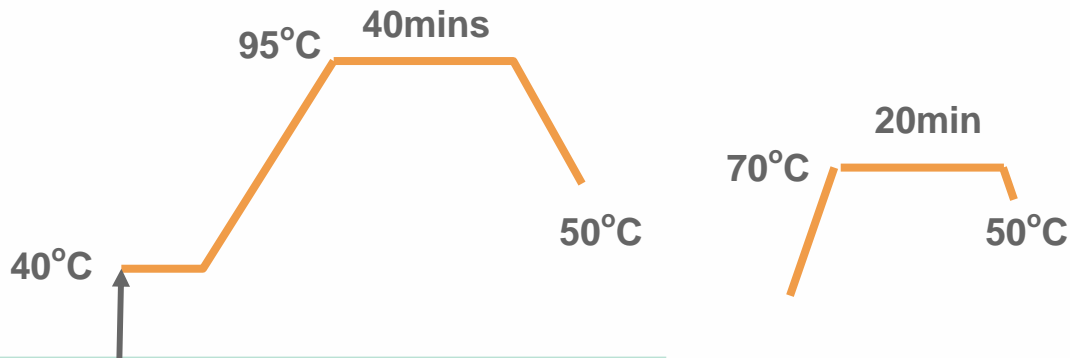
## Ingeo™ fibre / cotton Pre bleach - Peroxide



# Ingeo™ fibre dyeing and finishing - Dye cycles

## Ingeo™ fibre / cotton

Alternative pre bleach - TAED (tetra acetyl ethylene diamine)  
Good white base with decreased hydrolysis



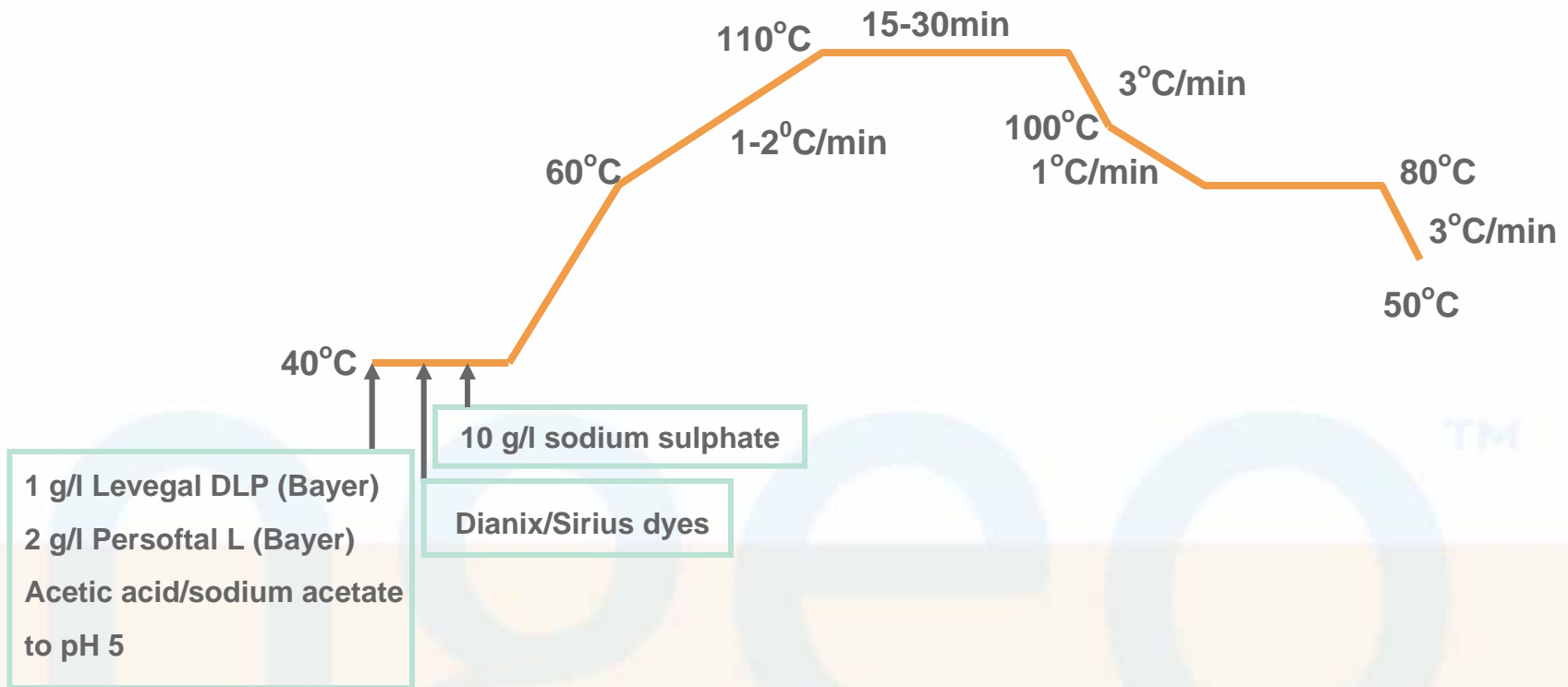
0.5g/l  $\text{Na}_2\text{CO}_3$   
5.0cc/l Hydrogen peroxide (35%)  
2.0g/l Warwick T202 (TAED)  
1.0g/l Pitchrun L300 (scouring agent)  
1.0g/l Neocrystal CG2000 (sequestering agent)  
1.0g/l Neorate PLC7000 (peroxide stabiliser)

Neutralise with acetic acid if needed



# Ingeo™ fibre dyeing and finishing - Dye cycles

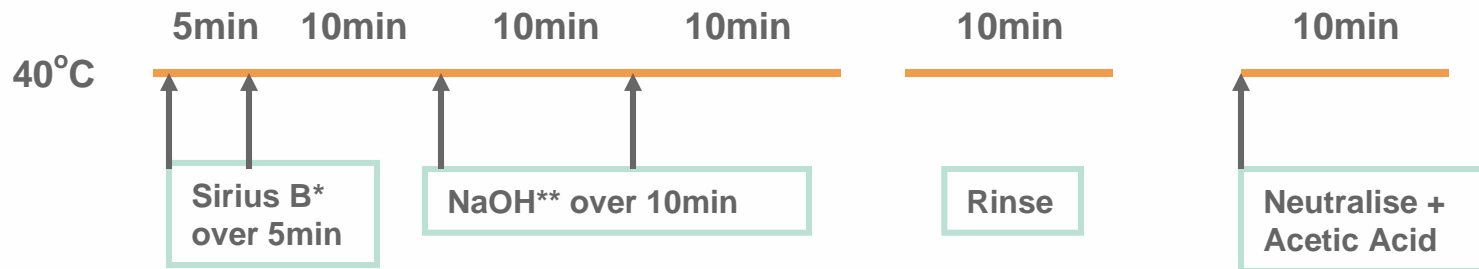
## Ingeo™ fibre/cotton Disperse / Direct - one bath



## Ingeo™ fibre dyeing and finishing - Dye cycles

### Ingeo™ fibre /cotton

Disperse / Direct - one bath + after treat for darker shades



\* % Sirius B = 1.0 + (1.5 x %of total direct dye)

*Minimum 1.5%/ maximum 7.0%*

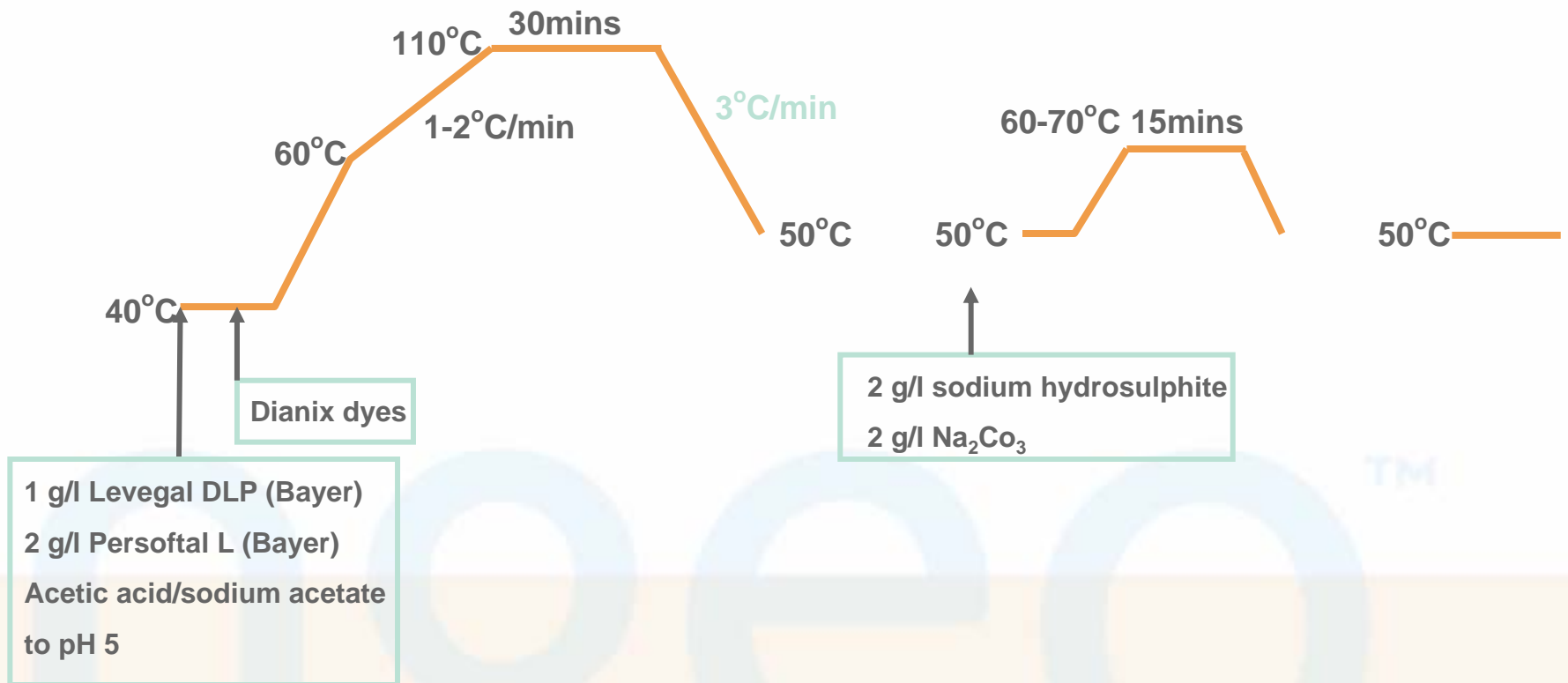
\*\* cc/l NaOH (40%) = 1 + amount of Sirius B ( in %)

*Minimum 2.5%*



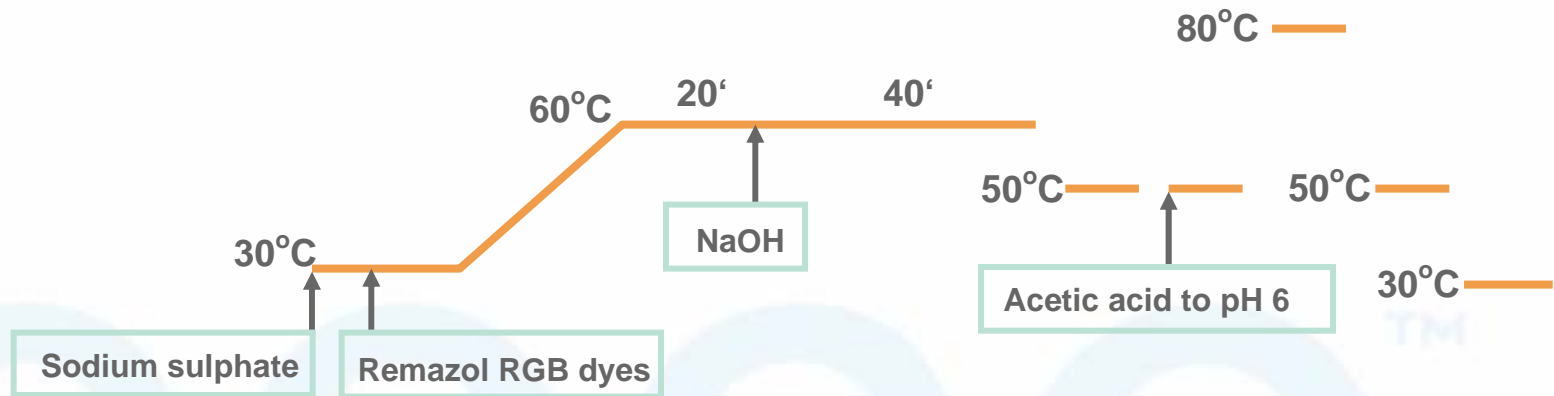
# Ingeo™ fibre dyeing and finishing - Dye cycles

## Ingeo™ fibre/ cotton (start point for trials only) Disperse / Reactive - stage 1



## INGEOTM Dyeing and Finishing - Dye cycles

Ingeo™ / cotton (start point for trials only)  
Disperse / reactive - stage 2



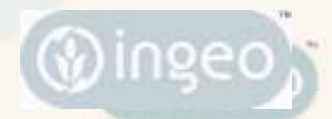


# Apparel Product Guidelines

## 6. Dye cycles

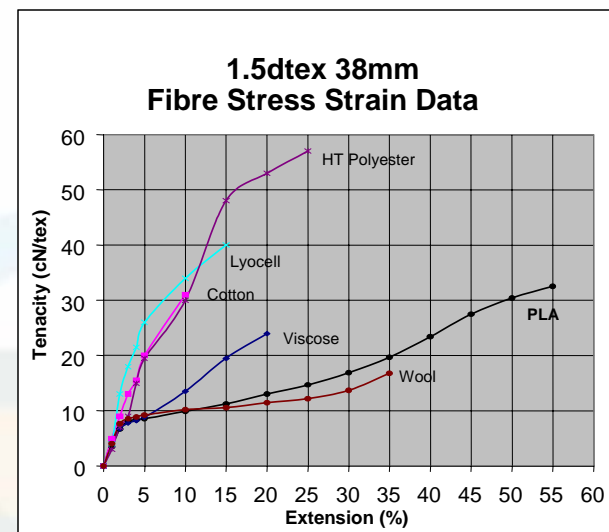
- 100% Ingeo™ fibre
- Ingeo™ fibre / cotton
- **Ingeo™ fibre / wool**
- Package dye

NB – there has been limited work on dyeing of Ingeo™ fibre blended with wool, and the information provided is based on our best knowledge to date. It can only be taken as guidelines for development work.



### General considerations - Ingeo™ fibre and wool are highly compatible

- Both fibres dislike high temperature and alkali combinations:
  - The pH dyeing conditions for Ingeo™ fibre are good for wool
  - The lower dyeing temperature of Ingeo™ fibre affords more protection to wool than PET blend dyeing
- Stress / strain curves are similar:
  - Indicates compatibility in most stages of processing



## General considerations for Ingeo™ fibre / wool blend dyeing :

- Disperse dyes will cross stain on wool
  - Can cause fastness issues  
(Similar issues on dyeing PET / wool blends)
  - After treatment to minimise cross staining is vital (particularly for dark shades)
- Wash fastness is limited to 40°C tests (e.g. AATCC 1A / C06, A2S)

## Suggested dark shade recipes for Ingeo™ / wool - standard fastness

(start point for lab trials only) :

### Black

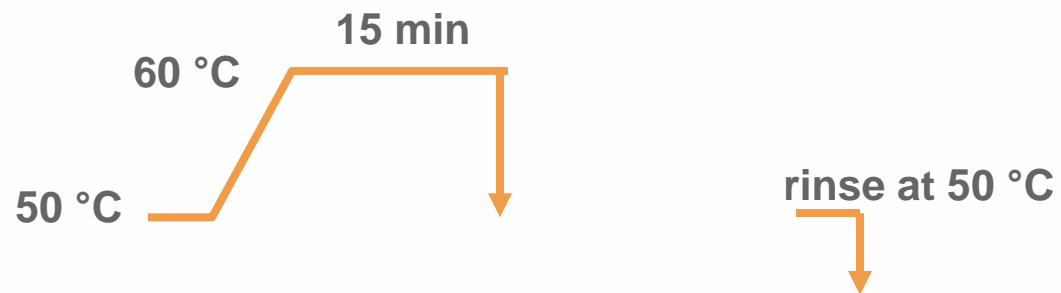
- Dianix Flavine XF 0.19%
- Dianix Yellow Brown CC 1.45%
- Dianix Turquoise S-BG 0.29%
- Dianix Dark blue SE-3RT 2.20%
- Isolan Black 2S-LD 1.13%

### Navy

- Dianix Flavine XF 0.18%
- Dianix Turquoise S-BG 0.42%
- Dianix Dark Blue SE-3RT 2.36%
- Isolan Dark Blue 2S-GL 1.08%



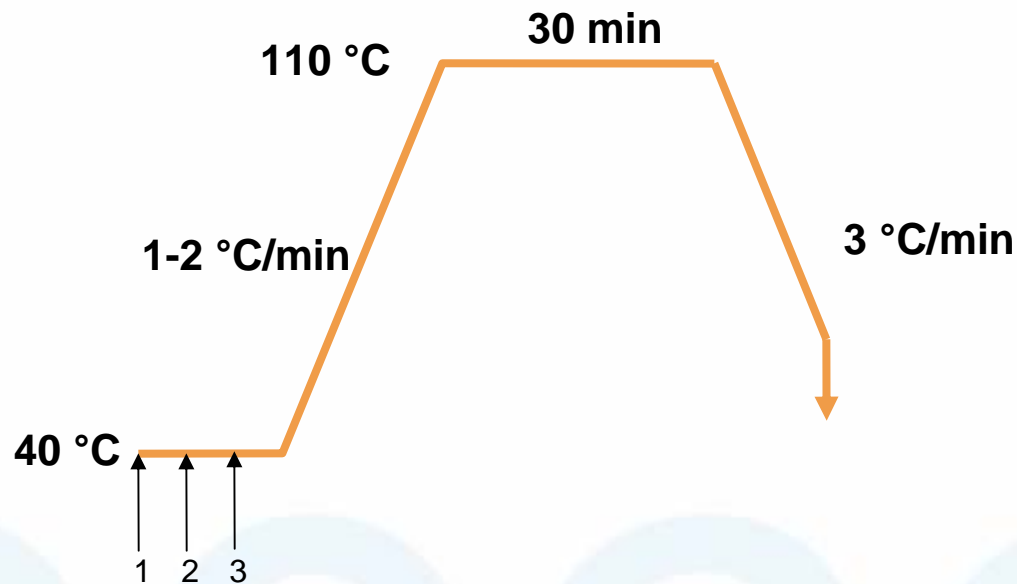
## Scour (DyStar)



1 g/l Diadavin® UNJ (Bayer/Sybron) or  
Kieralon® MFB (BASF)  
2 g/l soda ash.



## Dye (DyStar)



- 1) 1 % Avolan UL® DLP (Bayer/Sybron)  
1 g/l Avolan IS® (Bayer/Sybron)  
pH 4.5-5 acetic acid
- 2) X % Dianix dyes
- 3) Y % Supralan / Isolan dyes





## Aftertreat (DyStar)

rinse at 50 °C

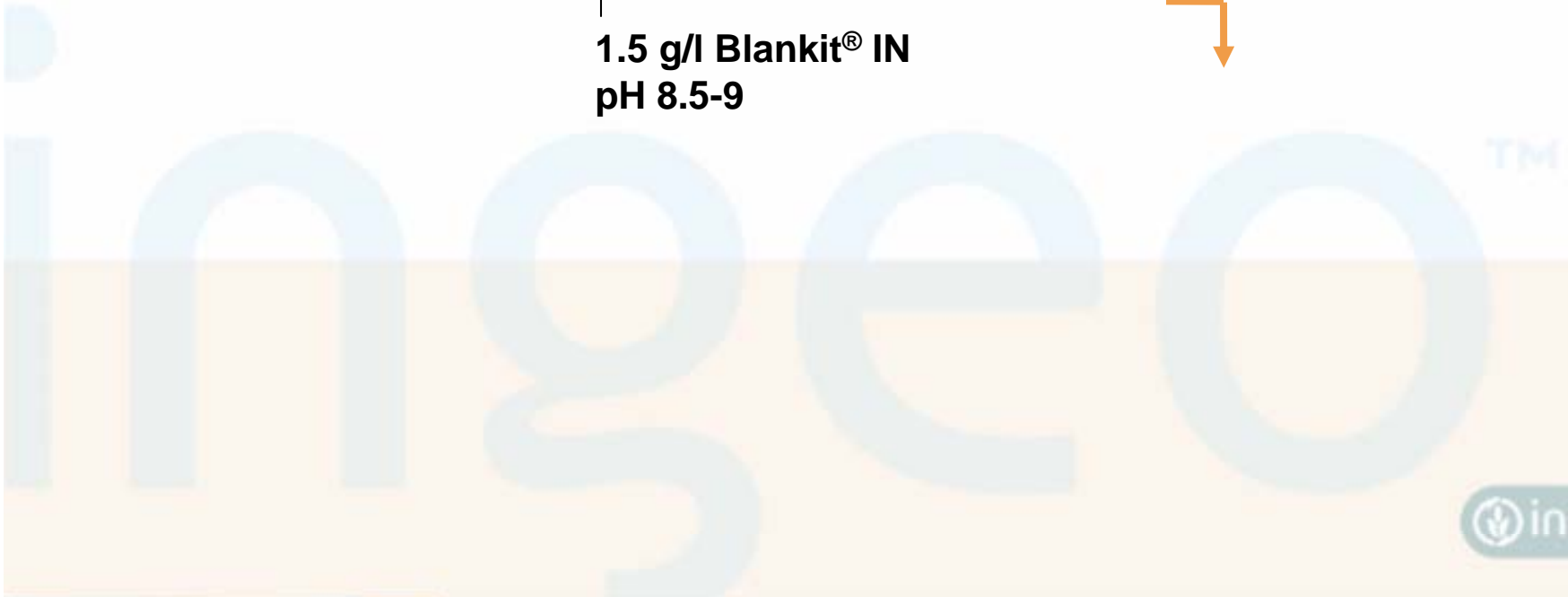


1.5 g/l Blankit® IN  
pH 8.5-9

rinse at 50 °C



rinse at 30 °C

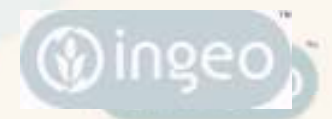




# Apparel Product Guidelines

## 6. Dye cycles

- 100% Ingeo™ fibre
- Ingeo™ fibre / cotton
- Ingeo™ fibre / wool
- **Package dye**





## Ingeo™ fibre Staple Yarn – package dyeing

- **Limited experience**
  - **Winding**
    - Density as PET ~ 0.35gm/cc
    - Minimal yarn shrinkage = minimal increase in package density after dye
  - **Dyeing**
    - Suggested dye cycle (start point for trials only) as follows

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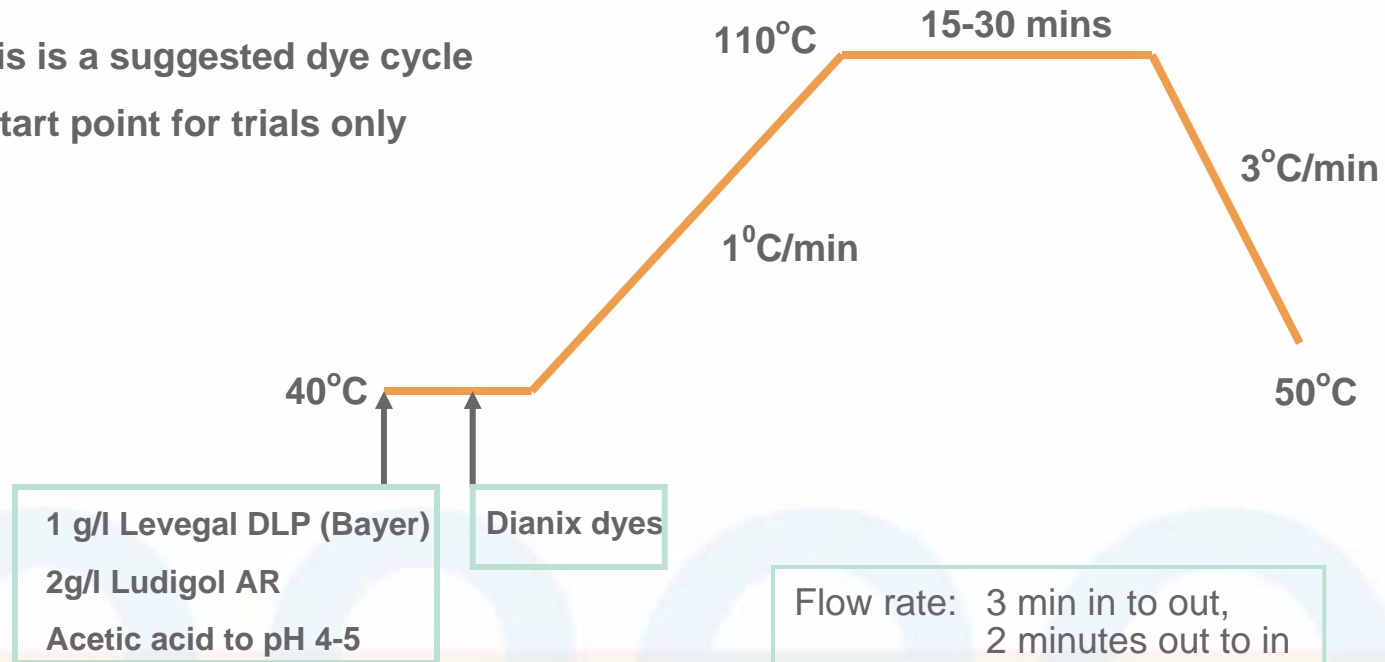


# Ingeo™ fibre Staple Yarn – package dyeing

## Ingeo™ fibre yarn package dye cycle

(scour, reduction clear etc - as for fabrics)

**NB this is a suggested dye cycle  
as a start point for trials only**



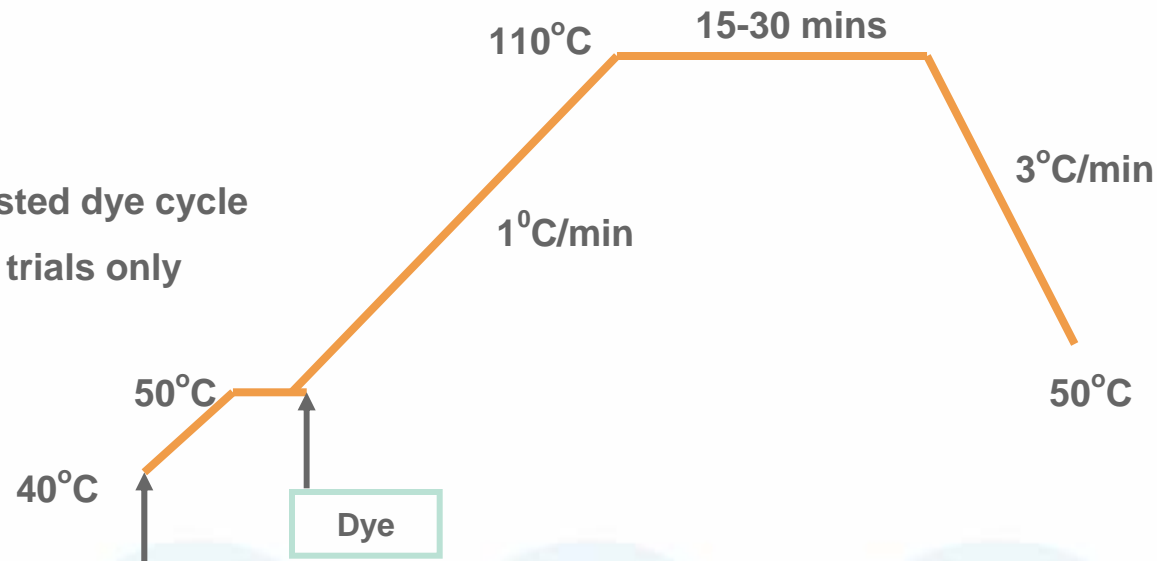
Similar cycle is also appropriate for top dye

# Ingeo™ fibre Staple Yarn – Package Dyeing

## Ingeo™ fibre yarn package dye cycle

- alternative system with MSP (Mono sodium phosphate) buffer  
(scour, reduction clear etc - as for fabrics)

NB this is a suggested dye cycle  
as a start point for trials only



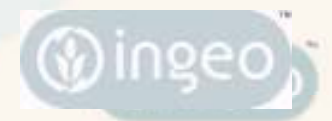
MSP to pH 5.0 - 5.3  
Plus additional 4 g/l MSP  
2.0 g/l Basol WS,  
0.25 g/l Milease T (Lubricant)

Flow rate: 3 min in to out,  
2 minutes out to in



# Apparel Product Guidelines

## 7. Atmospheric dyeing





## Ingeo™ fibre - atmospheric dyeing

- **Limited lab work suggests:**
  - **Selected dyes give adequate exhaustion at 100°C, 30min**
  - **Only pale to medium shades**
  - **AATCC 1A fastness**
- **Trichromatic combination as start point for trials only:**



Dianix Deep Red SF



Dianix Yellow Brown XF



Dianix Dark Blue SE-3RT

**Significant for sweater yarn and garment dyeing**



## Ingeo™ fibre - atmospheric dyeing

- **Process cycle**
  - **Scour** – as for 100% Ingeo™ fibre
  - **Dye** - as for 100% Ingeo™ fibre, but hold at 98°C for 30min instead of 110°C
  - **Reduction clear** - pale to medium shades, so not normally needed .... or mild process, eg Cyclanon ECO (DyStar)

ingeo™







More information at [www.ingefibers.com](http://www.ingefibers.com)



humanity, nature and technology in balance





**IMPORTANT NOTES:**

1) The information provided in this document is given in good faith based on the best knowledge of current technology.

The information provided can only be taken as a start point for trials to establish production routes for Ingeo™ fibre products.

Cargill Dow cannot be held responsible for any claims arising from the information contained within this document, howsoever caused.

2) Yarns produced from different merges, and from different suppliers of INGEO(TM) PLA fibers, may vary in dye uptake, which can influence the reproducibility of shades. It is therefore recommended that before carrying out any production dyeing on new merges or fiber from new suppliers, that the dye recipe is verified by a laboratory check.

This is a similar procedure to other man made fibers, and so similar practices should be adopted to control color reproducibility at the final coloration stage.

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