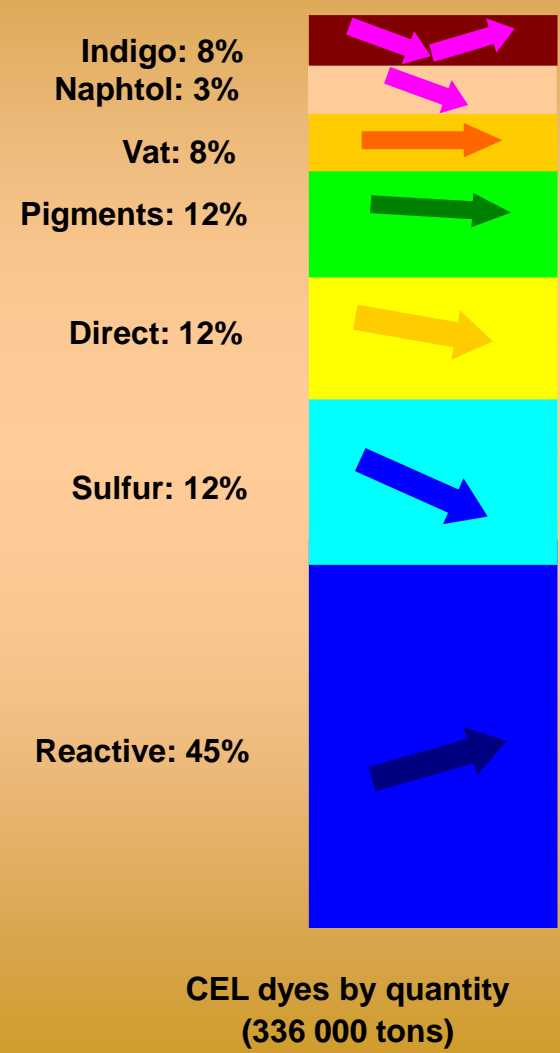


# Advances in reactive dyes

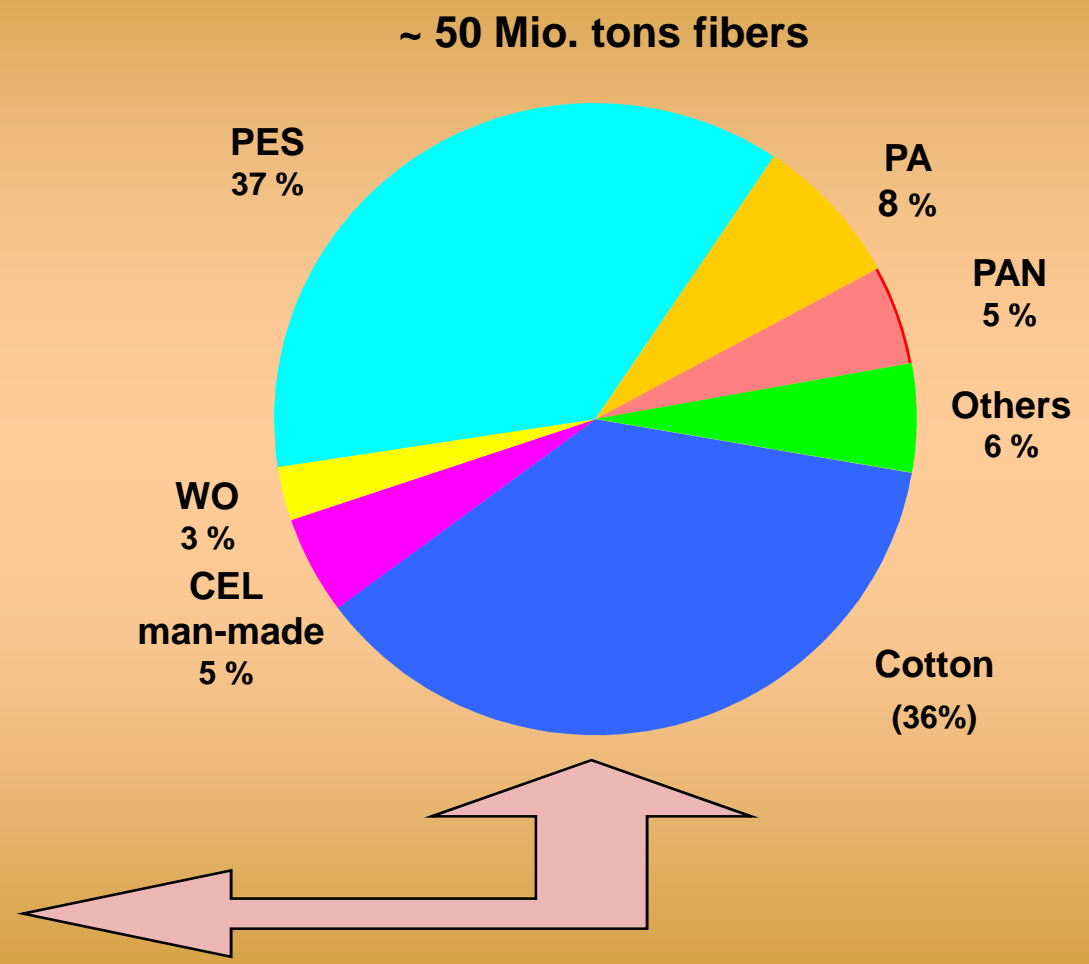


Convention on Colors  
Mumbai, February 2009

# Textile fiber consumption / dyes for cellulosic fibers



CEL dyes by quantity  
(336 000 tons)



The world wide consumption of textile fiber is dominated by CEL and PES  
Reactive dyes have gained the highest market share of all CEL dyes classes

## Major causes for market share increase of reactive dyes

- **Substantial increase in cotton consumption in recent years**
- **Concern about some technical/ environmental drawbacks of alternative dyeing methods and dyestuffs classes**
- **Strong demand for bright and deep shades**
- **Convenient, simple economical dyeing methods**

# Characteristics of reactive dyes (1965-1975)



## Strengths:

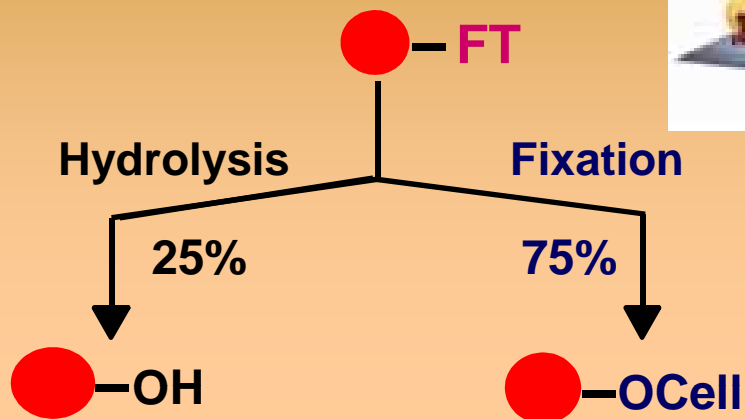
- Wide shade spectrum
- Excellent brightness
- Acceptable wet fastness level
- Suitability for all application methods

## Weaknesses

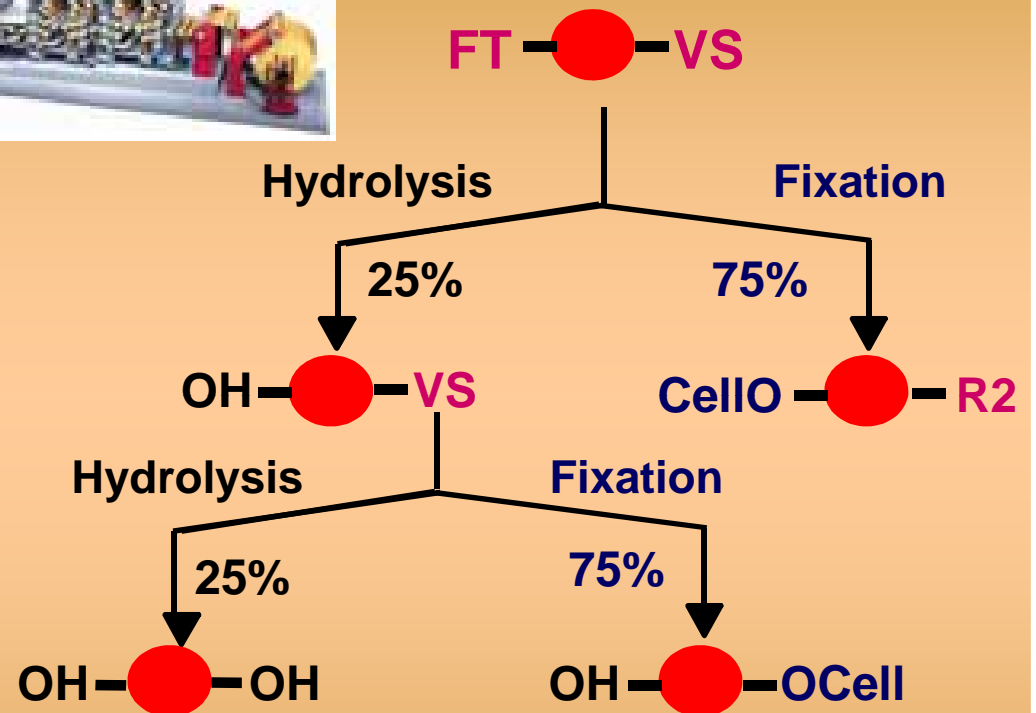
- high amounts of salt and long dyeing cycles (exhaust)
- low degree of fixation
- need for long washing-off cycles
- moderate light, wet-light, gas fading, photochromy issues and poor chlorine fastness in some shades
- Lack of reproducibility in critical shades

# Introduction of hetero-bireactivity end of 1980

## Monoreactive dye



## CIBACRON C



Washing 60°C

WO	PAC	PES	PA	CO	CA
Light yellow	Light yellow	Light yellow	Light yellow	Light pink	Light yellow

Fixation  
**75%**

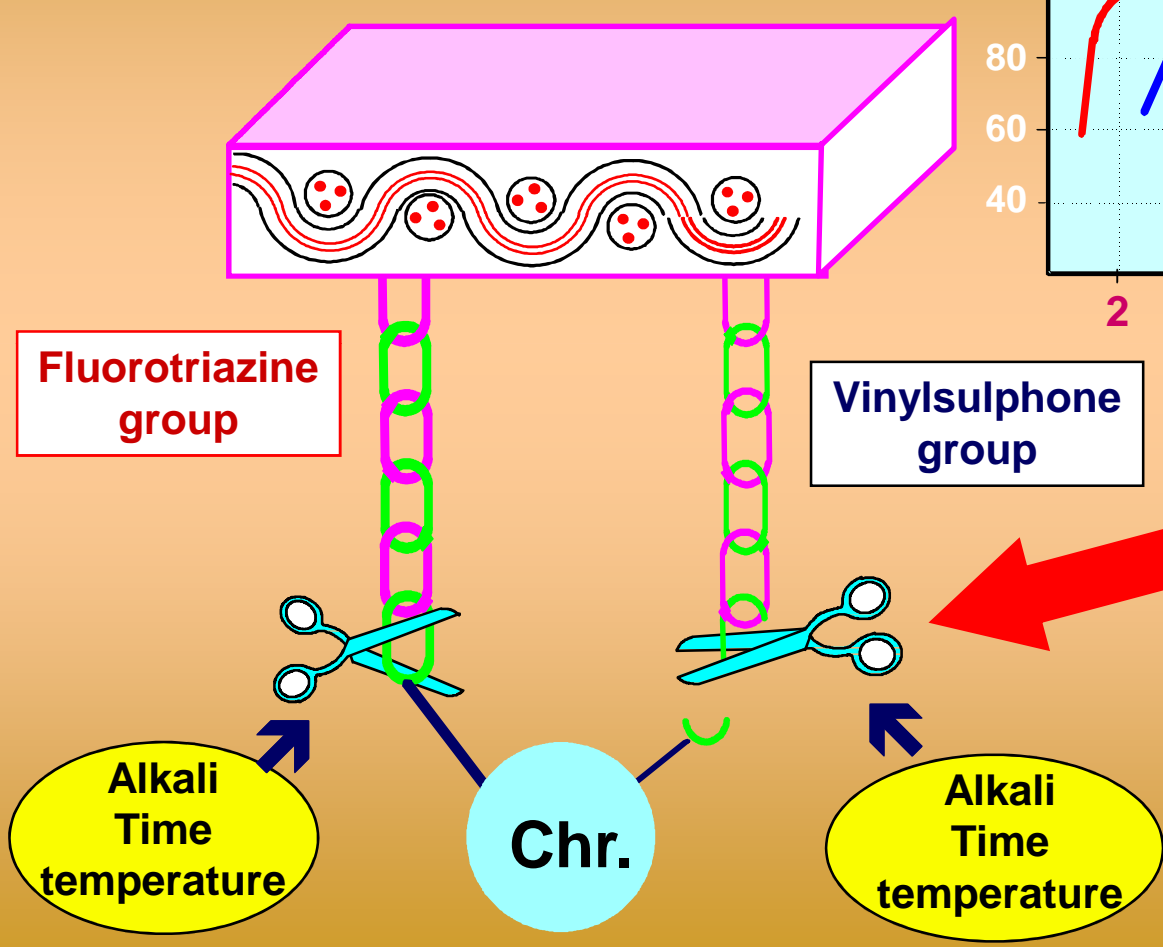
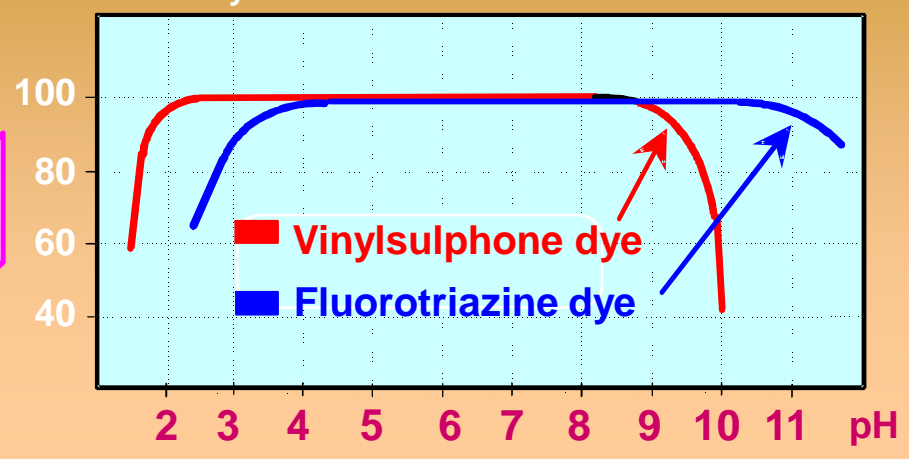
Washing 60°C

WO	PAC	PES	PA	CO	CA
Light yellow	Light yellow	Light yellow	Light yellow	Light pink	Light yellow

Fixation  
**93%**

# Advantage of FT/VS molecular engineering

Loss of yield



## Reduction of salt amount in dyeing bath

The addition of salt is time consuming and requires manpower



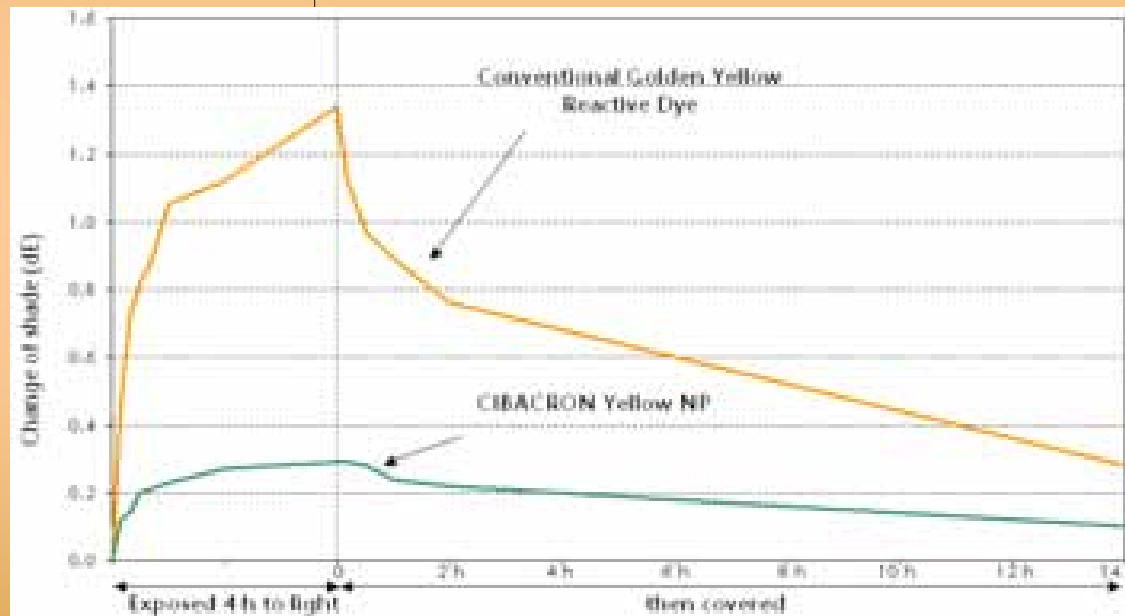
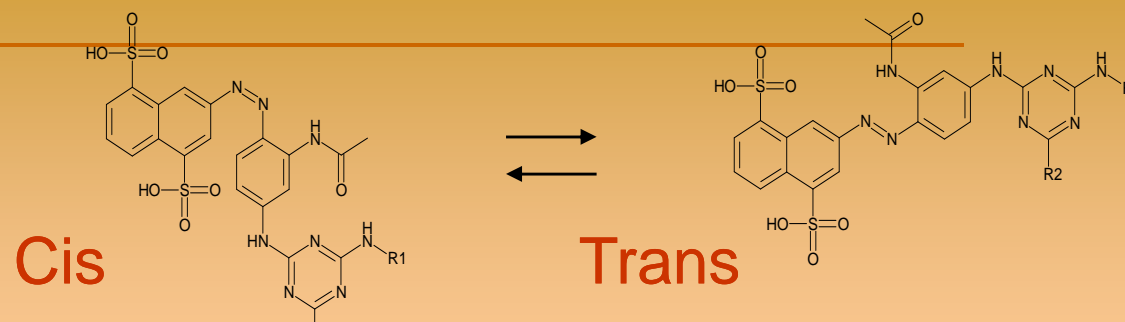
This is the amount of salt used for conventional reactive dyes



Time and cost saving, easier handling - The great benefits of NOVACRON LS



# Photochromy issues



A dyeing produced with a conventional golden yellow reactive dye, covered and then exposed to the light for 4 h.

Another dyeing produced with CIBACRON Yellow NP reactive dye, covered and then exposed to the light for 4 h.



# Earth tones.....

*Sand, brown, olive, beige, gris, khaki,*



*Always critical issues for the dyers !*

# Earth tones.....

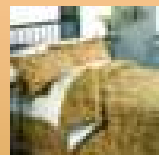
## For Apparel

Trousers, shirting, uniform, yarn, polo shirts, garment dyeing



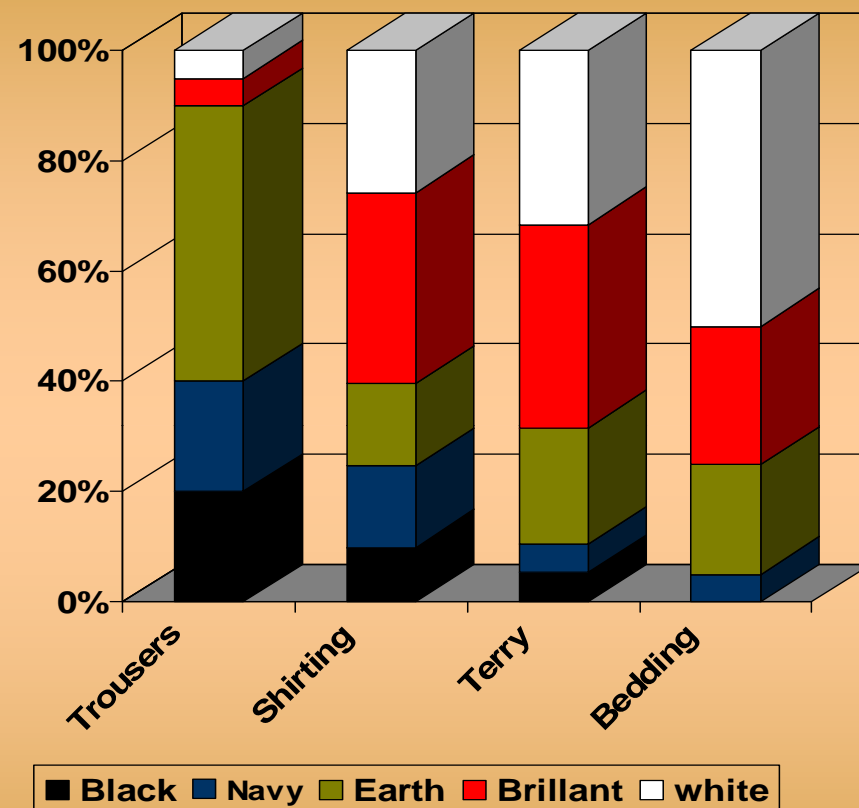
## For Home textile

Terry toweling, bed sheeting, textile for furnishing



## Dyeing processes

- Pad-batch
- Exhaust
- Continuous



Source: Huntsman's internal data

# NOVACRON NC Dyes

## Reactive dyes or vat dyes ?

### Why do dyers use/prefer reactive dyes instead of vat dyes

- Higher versatility of application processes (pad-batch, exhaust, continuous)
- Bright, fashion, deep shades achievable
- Meets most modern fastness requirements in Apparel and Home Textile
- Cheaper recipe cost particularly for medium/deep shades
- More simple dyeing / application procedures, better penetration
  - no reduction step
  - no oxidizing
- No specks by dyeing pale shades
- Higher productivity due to easier shade planning (reactive/vat product mix not easy to manage in bulk)
- Easier stripping and shade correction

# Use of vat dyes

## Apparel and Home textiles

For what shades do the dyers prefer using vat dyes?

**Especially for dyeing pale and medium shades, and when the brightness is not an issue**

## Reasons .....

**The reproducibility of vat dyes is much better but care must be taken to application conditions (dispersing, steaming, rinsing, oxidizing, soaping)**

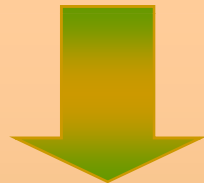
**The fastness requirement are fulfilled**

# NOVACRON NC Dyes

## Earth tones

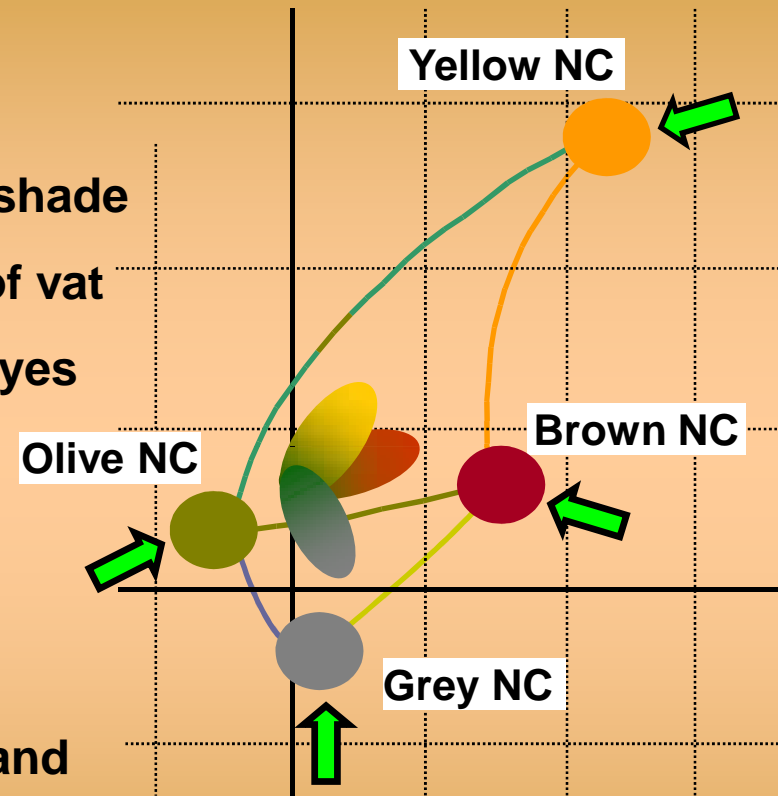
### The Solution !!

A selection of new reactive dyes having the shade of vat dyes, combining the reproducibility of vat dyes and that can be applied as reactive dyes



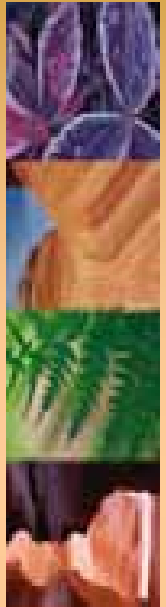
**NOVACRON NC (Non Contrasting)**

The new Concept for pad-batch, exhaust and continuous Applications



# NOVACRON NC Dyes

- FT chemistry, with 2-3 reactive groups
- Homogeneous NC self shades
- Non photochromic yellow component
- High compatibility within the range
- Designed for pad and exhaust application
- Non contrasting approach



**Reproducibility of shades**  
**Operational excellence**  
**End-use flexibility**  
**Fastness**



- mills
- brands and retailers
- machine suppliers

# Conventional dyes

Contrasting approach



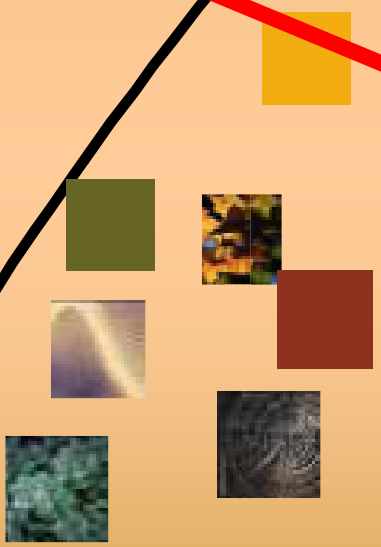
Conventional and current dye selection

Blue

Yellow

Red

Moderate / poor reproducibility, reprocess cost

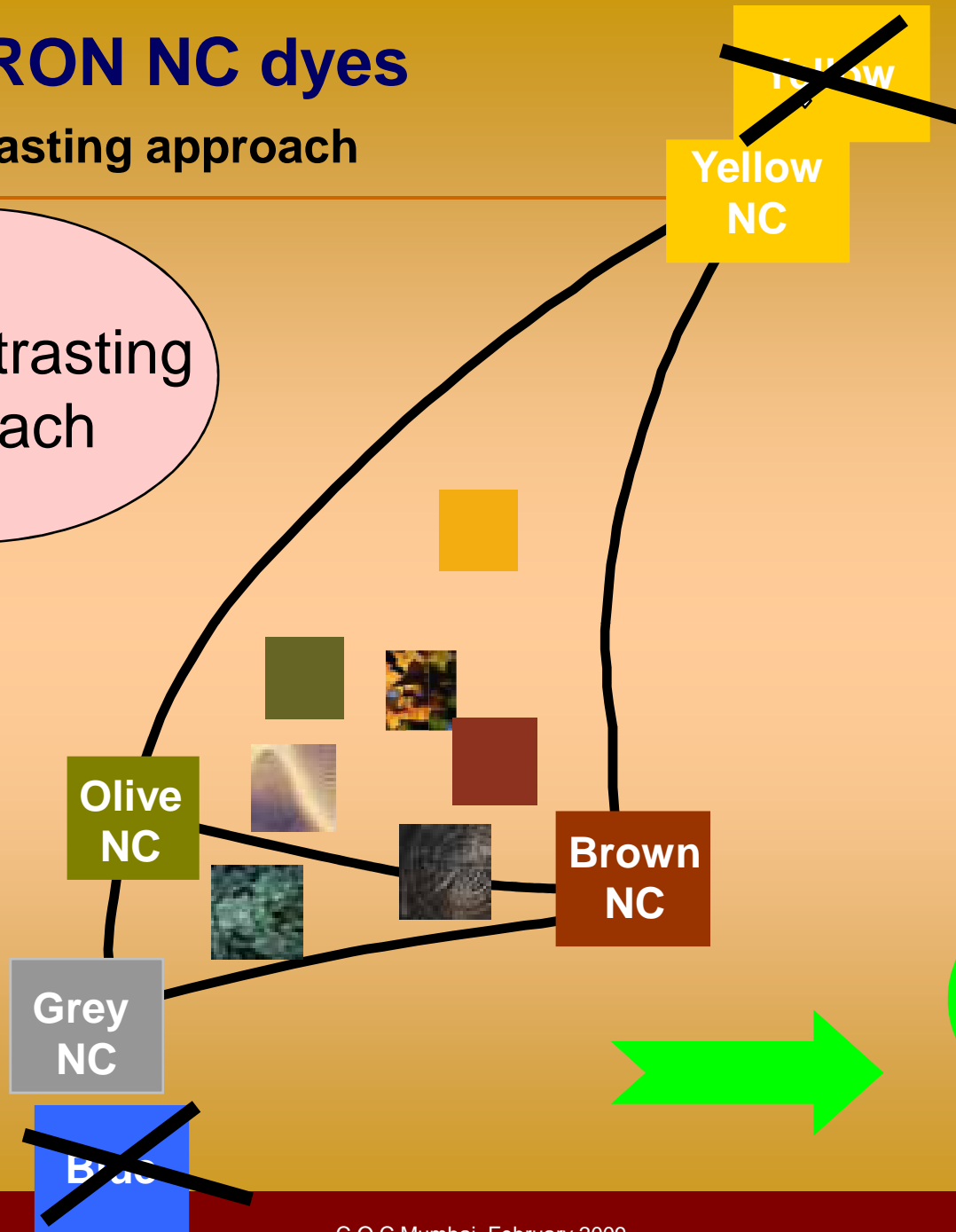


# NOVACRON NC dyes

Non Contrasting approach



Non Contrasting approach



Improvement of dyeing performances



# Principle of Non Contrasting effect

Conventional reactive dyes  
Yellow Red Blue



Reactive Yellow 4.20 g/l  
Reactive Red 1.90 g/l  
Reactive Blue 4.00 g/l

Non Contrasting NOVACRON NC reactive dyes  
Brown NC Olive NC Grey NC



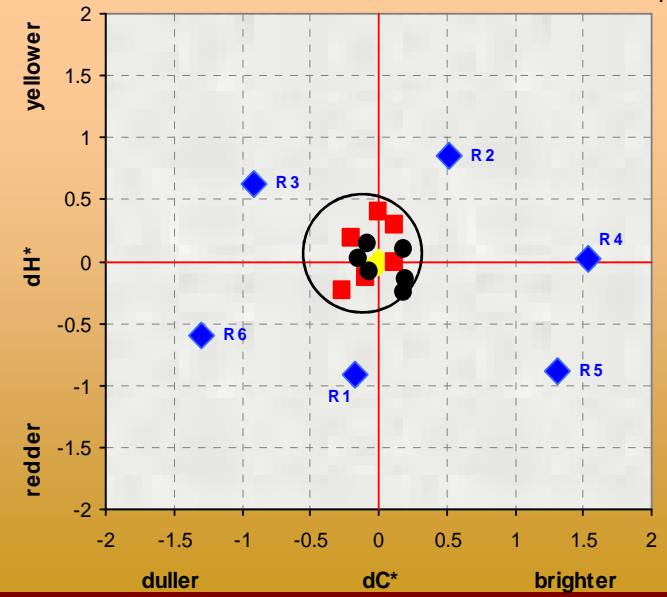
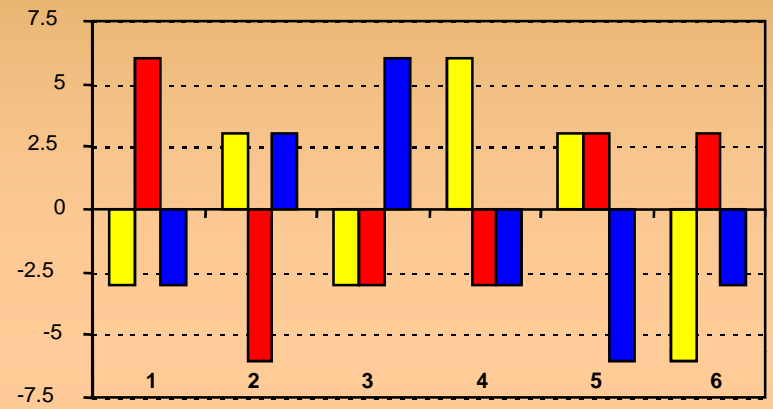
Novacron Brown NC 1.40 g/l  
Novacron Olive NC 6.80 g/l  
Novacron Grey NC 1.20 g/l

Conventional vat dyes  
Yellow 3R Brown BR Olive S/T



Novasol Yellow 3R md 0.60 g/l  
Novasol Brown BR md 1.60 g/l  
Novasol Olive S md 12.00 g/l

Variation of dye concentration in the recipe



See result on next slide !!!

# Principle of Non Contrasting effect

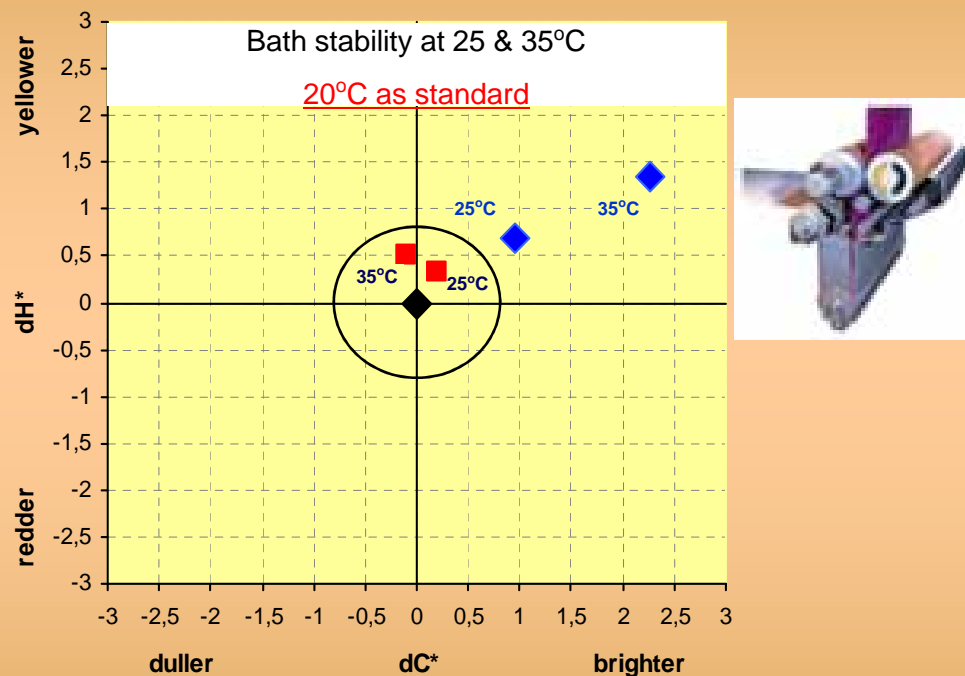


Any fluctuation of the behavior of conventional yellow/red/blue reactive dyes (i.e sensitivity to dyeing parameters as time-temperature, lack of compatibility) leads to shade changes that impair the results of the dyehouse.

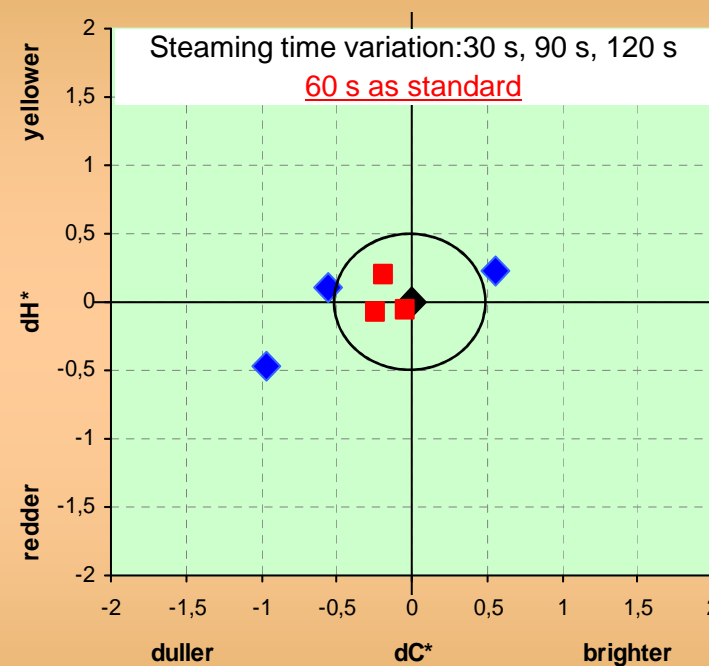
The newly developed HUNTSMAN NOVACRON NC reactive dyes allow for a tremendous improvement of dyehouse performances: Higher reproducibility, less seconds, cost saving and better competitiveness.

# Advantages of NOVACRON NC reactive dyes by pad-batch & continuous dyeing

**Influence of bath stability on shade variation  
Pad-batch process**



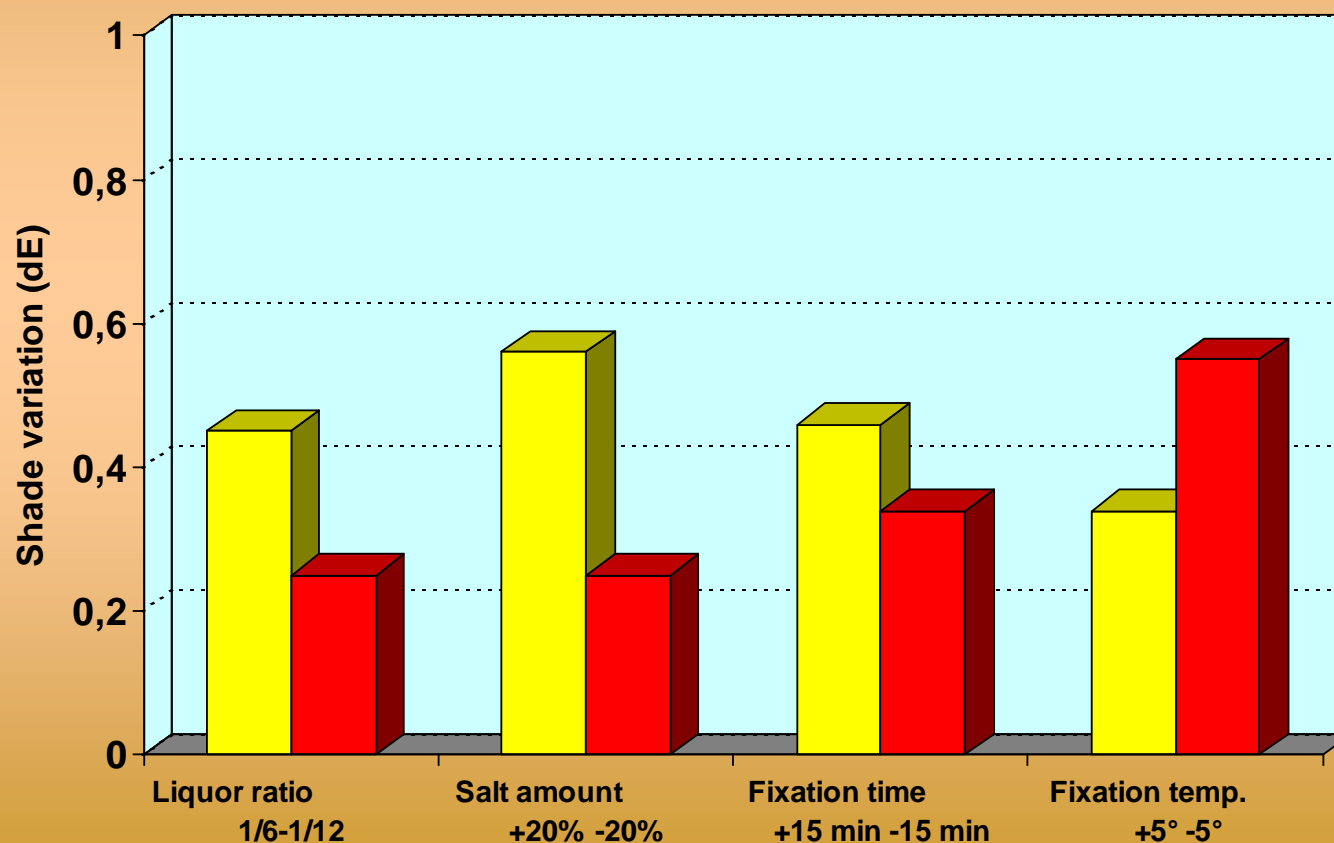
**Influence of steaming time variation  
Pad-dry-pad-steam process**



- Yellow NC / Brown NC / Olive NC Non Contrasting reactive dyes
- Conventional Yellow / Red / Blue reactive dyes

# Advantages of NOVACRON NC reactive dyes by exhaust dyeing

**Influence of dyeing parameters fluctuations on shade reproducibility**



**Standard conditions**  
 0.036 % Novacron Yellow NC  
 0.020 % Novacron Brown NC  
 0.123 % Novacron Olive NC  
 30 g/l common saltsal  
 10 g/l soda ash  
 LR: 1/10  
 300 kg single jersey  
 Isotherm process, 60°



# Advantages of NOVACRON NC by exhaust dyeing. Comparison with conventional reactive dyes

## NOVACRON NC recipe:

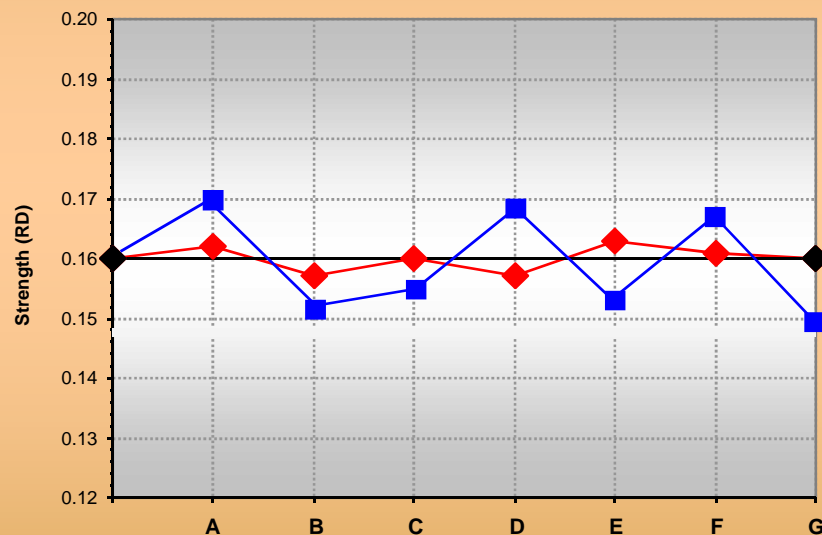
0.153 % NOVACRON Yellow NC  
0.031 % NOVACRON Brown NC  
0.122 % NOVACRON Olive NC

## Conventional recipe:

0.187 % Reactive Yellow  
0.070 % Reactive Red  
0.092 % Reactive Blue

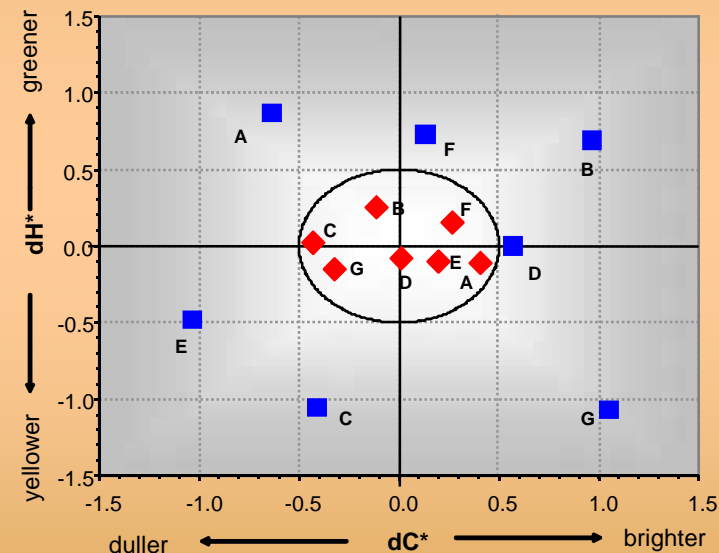
### Strength difference

◆ NOVACRON NC reactive dyes



### Shade variation

■ Conventional reactive dyes



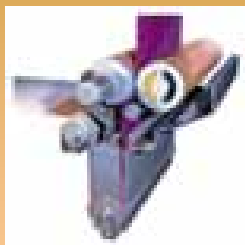
## Standard application conditions

Dyeing temperature: 60°C  
Fixation time: 45 min  
Liquor ratio: 1/10

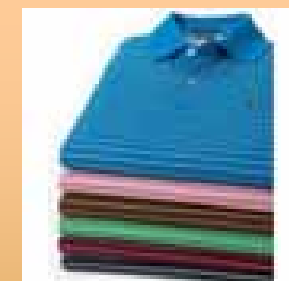


- A: Salt + 20%
- B: temperature - 5°C
- C: temperature + 5°C
- D: Alkali +20%
- E: Fix. time: +15 min
- F: LR 1:6
- G: LR 1/12

## Advantages of NOVACRON NC reactive dyes by exhaust and continuous application



Any variation of the application conditions by pad-batch, exhaust or continuous application has practically no influence on the shade of NOVACRON NC dyes



**Consistency,  
Reproducibility,  
Competitiveness**

**will consequently be tremendously improved**

# NOVACRON NC Dyes



## Benefits for the mill

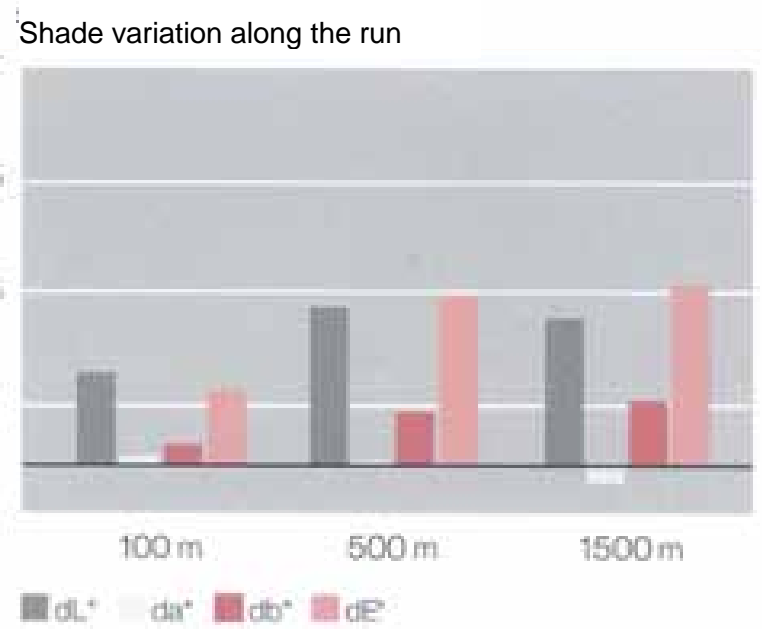
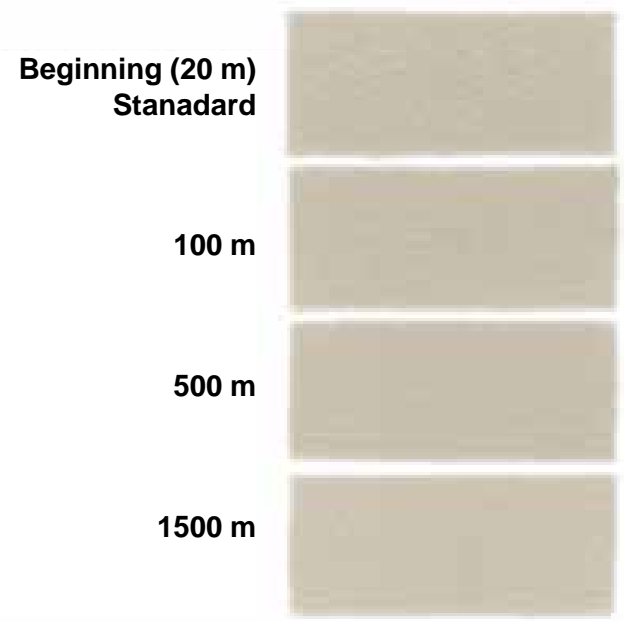
- Four dimensional consistency and outstanding reproducibility
  - 1 **No tailing** in the length
  - 2 No center-side shade variation in the width
  - 3 No two-sidedness in the tickness
  - 4 The same shade today, tomorrow and the day after
- Increase of productivity by reducing complex processes
- Outstanding fastness level satisfying the most stringent customers requirements
- Suitable for subsequent enzyme/stone wash, moist cross linking/ FR/ NH3 post-treatment and post-mercerizing with minimal shade change allowing for easier shade management
- Cost saving due to much lower effluent load (no need for sodium silicate, salt, hydrosulfite) and more efficient maintenance

# Shade variation along the run

**Tailing free dyeing pale shades with NOVACRON NC reactive dyes has become a reality**

0.36 g/l Novacron Yellow NC  
0.20 g/l Novacron Brown NC  
1.23 g/l Novacron Olive NC

Fabric: Cotton Gabardine merc.1650 m batch  
Pad-batch dyeing method, silicate free  
Standard: beginning of the run , 20 m




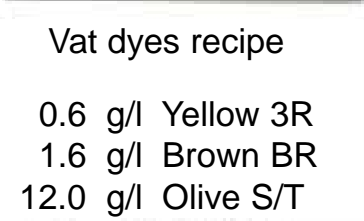




# NOVACRON NC reactive dyes

## Advantages over vat dyes

### Influence of steaming and development conditions

	NOVACRON NC	Vat dyes
Steaming with fully saturated steam		
Steaming with <b>not</b> completely saturated steam (3-4% air)		
	NOVACRON NC recipe	Vat dyes recipe
	1.4 g/l Brown NC 1.2 g/l Grey NC 6.8 g/l Olive NC	0.6 g/l Yellow 3R 1.6 g/l Brown BR 12.0 g/l Olive S/T

Shade variation  
Lack of reproducibility  
Need for reprocessing

# Finishing

## NOVACRON® NC dyes enhance finishing

Finishes such as easy care, moist-cross-linking, stain release and stain repellent, moisture management and anti-pilling add significant value to treated fabrics. The shade of conventional yellow/red/blue reactive dyes very often changes after finishing, leading to a complicated selection of dyes and/or application processes. Shades dyed with **NOVACRON NC** are particularly robust even under severe aftertreatment conditions. They show minimal variation after finishing and allow easier shade management and improved right-first-time performance.

### Pad-dry-pad-steam, bottom weight

1.90 g/l NOVACRON Yellow NC  
1.15 g/l NOVACRON Brown NC  
2.25 g/l NOVACRON Olive NC

Without finishing



With Easy care finishing



### Pad-steam, shirting

0.22 g/l NOVACRON Yellow NC  
0.25 g/l NOVACRON Brown NC  
0.55 g/l NOVACRON Olive NC

Without finishing



With MXL finishing



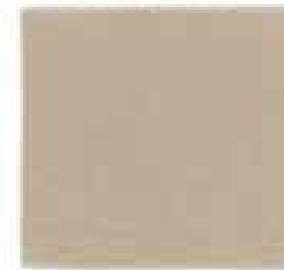
### Pad-batch, trousers

0.06 g/l NOVACRON Yellow NC  
0.49 g/l NOVACRON Brown NC  
1.75 g/l NOVACRON Olive NC

Without finishing



After enzyme washing

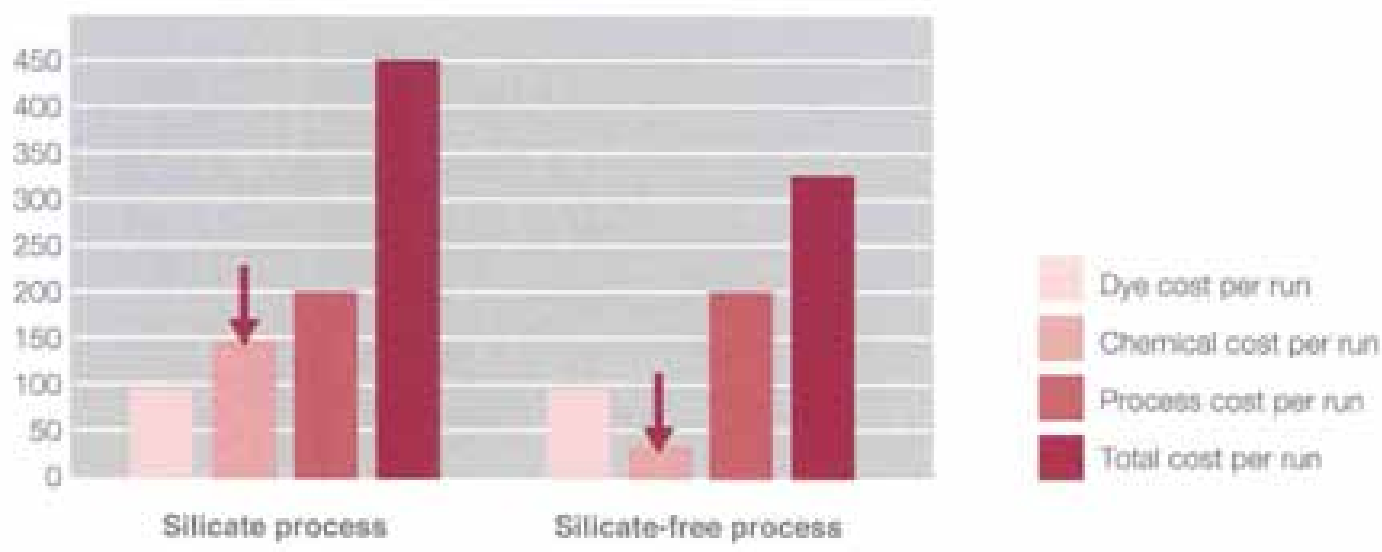


## Cost saving and ease of use with NOVACRON NC dyes

### Silicate-free pad-batch process—cost saving

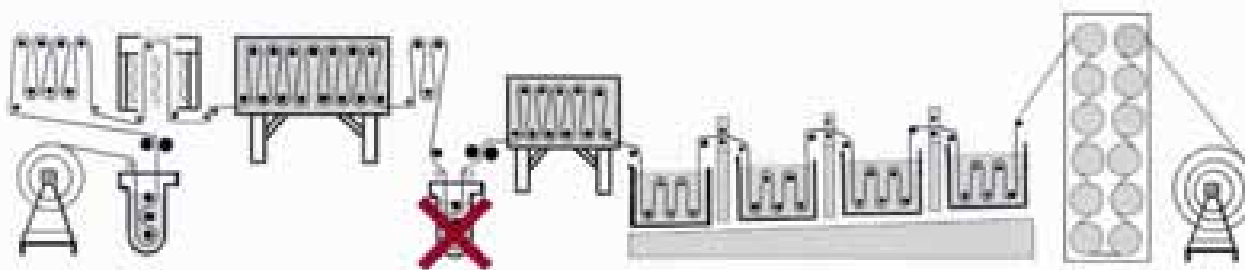
The silicate-free alkali systems for pad-batch used for **NOVACRON® NC** dyes offer advantages such as:

- prevention of incrustations/deposits on the padding mangle and feeding pipes which lead to deterioration
- no risk of precipitation/spots due to water hardness or by neutralization at washing step
- easier and faster range cleaning leading to increased productivity
- softer handle of dyed fabric
- easier and more efficient washing-off; no need for neutralizing
- much cheaper recipe cost, especially by dyeing pale shades



# Cost saving and environment protection with NOVACRON NC dyes

## Pad-dry-steam instead of pad-dry-pad-steam—cost saving and easy handling



NOVACRON<sup>®</sup> NC dyes can be applied by the continuous pad-dry-steam process without chemical pad. This method offers several advantages over the conventional pad-dry-pad-steam process:

- no need for salt
- shorter process and time saving (no need to prepare highly concentrated salt solution or brine)
- no tailing due to absence of dye desorption in the chemical trough
- no corrosion of the steamer; less maintenance and longer life cycle of equipment
- no more effluent load and saving of water cost treatment

A pad-dry-pad-steam production of 1 million meters/month will require about 700 tons of common salt per year (about 14,000 salt bags, 20–30 trucks) and an additional water consumption of 250,000 liters/month salty water.

## Bulk production

Fabric:	2300 m batch, 2/1 gabardine bleach, mercerized, 330 g/turning meter
Running speed:	50 m/min
Padding:	1.2 g/l NOVACRON Yellow NC 2.3 g/l NOVACRON Brown NC 4.5 g/l NOVACRON Olive NC 1.0 g/l ALBAFLOW PAD 10.0 g/l THERMACOL MP 10.0 g/l sodium bicarbonate
Drying:	IR predrying + hotflue drying at 100–120°C
Steaming:	1 min with saturated steam
Washing-off:	open width, water consumption: 6 liters/kg fabric

# NOVACRON NC Dyes

## Fastness properties



### A new state-of-the art in reactive dyeing

- **Fast to light (ISO, AATCC 16 E, 60AFU)**
- **Fast to wet light and perspiration light (Nike/Adidas)**
- **Fast to nitrogen oxide (gas fading) and ozone**
- **Fast to chlorine (20 mg/l, home laundering)**
- **Fast to peroxide (M&S C10A)**
- **Fast to repeated washing (30x at 60°C) tested according European and US conditions**
- **Fast to post mercerizing**





**NOVACRON NC Dyes**

***Earth tones made easy***

**Let's do it together**

# Promotion material

