

Textile Effects

Wool at its best!

Chrome dyes vs LANASOL® reactive dyes: An industrial scale comparison





Chrome replacement— achievements in a nutshell

- Cost saving
- Quality improvement

Benefits evaluated and proven in real live production

- **Cost reduction and higher efficiency in spinning**

- More than 50% less end breaks
- 50% less faults on the autoconer

- **Higher spinning yield—less waste of wool fibers**

- At least 8 kg more yarn from 1 ton of wool

In the mill with a daily spinning capacity of 16 tons of top dyed wool the increase of spinning yield from 95.6 to 96.4% means yearly savings of 784.000 USD (with a yarn price of 28 USD per kg).

- **Cost saving in wool purchasing**

- Average fiber length improved by 5 mm Hauteur
- Finer yarns can be produced

Chrome dyes—a historic review

Chrome dyes used to be the choice of wool dyers for producing deep shades such as black and navy. However, in order to attain their full shade and good fastness properties, these dyes require after treatment with a heavy-metal mordant which is detrimental to human health and the environment. Today, many wool processors, top global brand owners and retailers have already restricted the use of chrome dyes with some industries opting for a total metal-free approach.

Traditional techniques vs state of the art with LANASOL® CE dyes

Chrome dyes are mainly used for dark shades on wool. These dyes require an after treatment with a mordant to develop the required fastness properties and the correct shade. This mordant is a hexavalent chromium salt that is dangerous to health by ingestion, inhalation or even skin contact. Residual chromium on the dyed wool or in dyehouse effluent is an additional health and environmental hazard.

At first sight, chrome dyes are cheap, and if applied correctly much of the chromium is fixed to the wool making it ecologically acceptable. Chrome dyes level well and have high fastness properties. Because they are well established, conservative dyers are reluctant to switch to new products and processes without clear economic or quality benefits.

What are the risks with chrome dyes in spinning?

Normal processing conditions with chrome dyes weaken and damage the fiber resulting in shorter than average fiber lengths, more noil and/or higher short fiber content. Typically, after chrome dyeing there is an approximate 10% loss in strength (g/tex) and up to 20% loss in fiber extension.

Furthermore, after every end breaks in spinning, the two ends of the broken yarn are overlapped and spliced (“spinners double”) which causes a serious yarn fault that has to be subsequently removed. The consequence is lower spinning yield due to fiber loss.

What are the benefits of LANASOL®?

LANASOL® dyes achieve the same high fastness ratings as chrome dyes with a noticeable difference: In severe tests like fastness to potting or to cross dyeing, chrome dyed black wool stains the adjacent fabric yellowish (off tone). LANASOL® CE dyed wool stains adjacent fabric on tone and keeps its required shade. Because of the chemical nature of Lanazol reactive dyes they inhibit chemical damage during dyeing and preserve the qualities of the ecru fiber.

LANASOL® CE dyes benefit from an EU award for best available technology (BAT).

The future is LANASOL® CE:

- Concern for the Environment
- Chrome Exchange
- Cost Effectiveness

TESTS



Reliable tests

An industrial scale comparison

One of the largest worsted mills in the world compared their chrome process with Huntsman's LANASOL® dyeing process.

2 tons of wool were split, one half was dyed with Chrome Black and the other half was dyed with LANASOL® Black. Both batches were spun with the same parameters:

- 19.5 micron wool
- Yarn count 1/71Nm
- Fibers in cross section: 33
- Spinning speed: 7'800 rpm
- Single twist 719 turns per metre (85.4 α)
- Folding twist 799 turns per metre (135 α)

During all processing steps data were collected and compared inhouse as well as in an independent institute.

Dyeing Recipes: A real life comparison

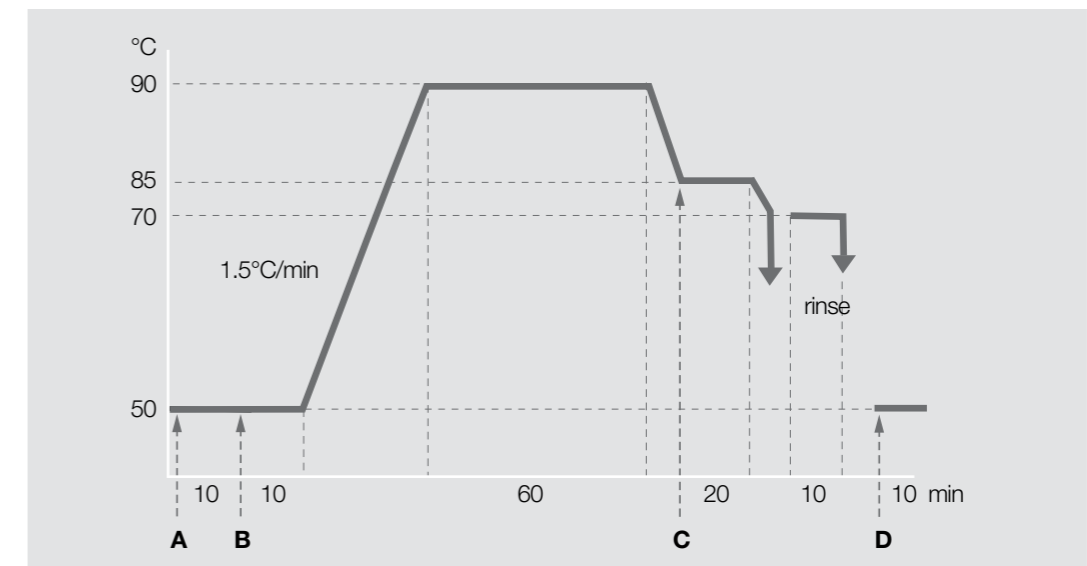
Chrome dyeing recipe

5 dye-batches of 200 kg wool were dyed with chrome dyes according to the customer's well established day-to-day procedure without any modifications:

4.2	%	Chrome Black PWV
0.4	%	Chrome Yellow 2G
0.4	%	Chrome Red S80

LANASOL® recipe

5 dye-batches of 200 kg wool were dyed according to the following procedure:



A	0.5 g/l ALBEGAL® FFA	B	4.55 % LANASOL® Deep Black CE-2B
	2.0 % MIRALAN® LTD		0.50 % LANASOL® Golden Yellow CE-01
	1.6 % formic acid 85%		0.40 % LANASOL® Red CE
C	5.25 g/l soda ash	D	1.0 % formic acid (85%)

Shade and depth were accepted by the mill as being equal to the chrome dyed wool.

The degree of dye fixation was determined to be 94% (the absorbance of the residual dye liquor was compared to diluted original dye liquor).

Dyeing parameters

Batch No.	1	2	3	4	5
Batch weight (kg)	200	200	200	200	183
Liquor/wool ratio	1:10	1:10	1:10	1:10	1:12
pH dyeing start (with dyestuff)	4.05	3.96	3.95	3.94	3.96
pH dyeing end (before adding soda)	4.50	4.35	4.36	4.33	4.35
pH after washing with soda ash	8.77	8.66	8.64	8.65	8.63
final pH (after neutralisation)	5.30	5.32	5.31	5.28	5.30

RESULTS



Convincing results

Backwashing and drying

For consistency both chrome and LANASOL® lots were processed under the same conditions. The LANASOL® dyed slivers on exit from the backwash and after drying more bulky, compared to the Chrome dyed lot. Bulky open slivers permit easier drying and consequently a lower regain after drying (mean regain levels were 24.36 for chrome dyed and 15.55 for Lanasol dyed). There is a potential saving on energy costs for drying the LANASOL® dyed tops. Therefore, it is recommended that the backwash drier be adjusted in future to a lower temperature when processing LANASOL® dyed lots. The higher bulkiness is clearly visible even after drawing:



420 m Chrome dyed wool sliver after combing



420 m LANASOL® dyed wool sliver after combing

Average fibre length after dyeing, backwashing, re-combing/finishing and drawing

Lot	As delivered	Backwashing	Blending	Re-combing Finishing	Drawing
Ecru Hauteur mm	72.4	Not applicable	No data	73.6	69.6
Chrome Hauteur mm	72.4	73.3	66.9	68.2	64.2
Lanasol Hauteur mm	72.4	72.6	69.0	72.3	69.9
Ecru % < 30mm	10.0	Not applicable	No data	8.3	10.6
Chrome % < 30mm	10.0	8.6	11.3	9.0	10.9
Lanasol % < 30mm	10.0	9.0	11.1	9.0	10.5

The length characteristics of the LANASOL® dyed lot is significantly better than the chrome dyed lot and even longer than the original Ecru lot. The Almeter average fiber length results after processing are a very good predictor of fiber strength and highlight the differences between dyestuffs. The LANASOL® dyed lot performed better than the ecru lot in terms of maintaining average fiber length and was far superior to the chrome dyed lot. Therefore, it is safe to conclude that the LANASOL® dyeing procedure is less severe on the fiber than the chrome process.

As a consequence finer high quality yarns can be produced with LANASOL® dyed wool.

Single yarn test results

	Ecru	Chrome	LANASOL®
Yarn count Nm	1/71	1/71	1/71
Irregularity CV%	20.9	23.0	22.1
Thin places/km	573	1066	842
Thick places/km	149	341	248
Nep/km	116	101	81
Yarn strength g/tex	6.0	5.0	5.2
Yarn extension %	5.9	4.3	6.3
End breaks/1000 spindle hrs	89	231	85

All the yarn quality parameters of the LANASOL® dyed yarn are far superior to the chrome dyed yarn and for the most part comparable to the ecru yarn.

On average yarns spun from the LANASOL® lot have 21% fewer thin places, 27% fewer thick places, 11% fewer neps and are 17% more extensible.

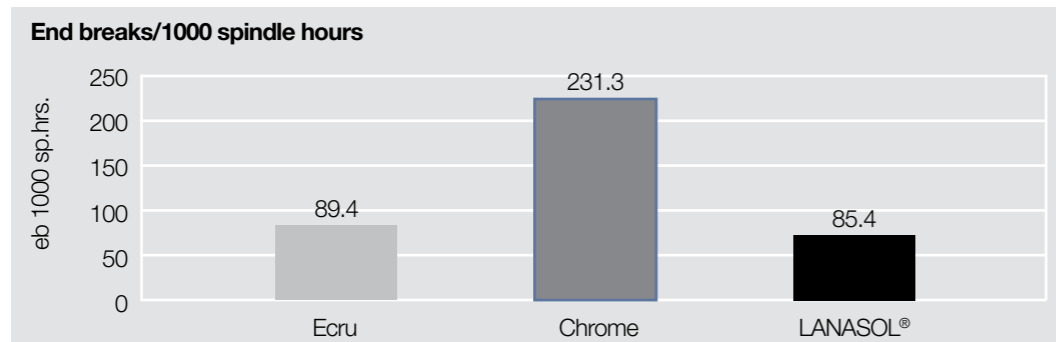
Most impressive is the figure of 63% fewer end breaks. The very high number of end breaks for the chrome dyed wool is related to the serious spinning conditions (71Nm yarn with only 33 fibers in the cross section, produced with a spinning speed of 7'800 rpm). This highlights even more the excellent performance of the LANASOL® dyed wool—even under extremely severe conditions a perfect yarn is spun. Differences of such magnitude lead to measurably better productivity in spinning, fewer clearer cuts during winding, better twisting and weaving efficiency and ultimately better fabric quality.

SAVINGS + BENEFITS



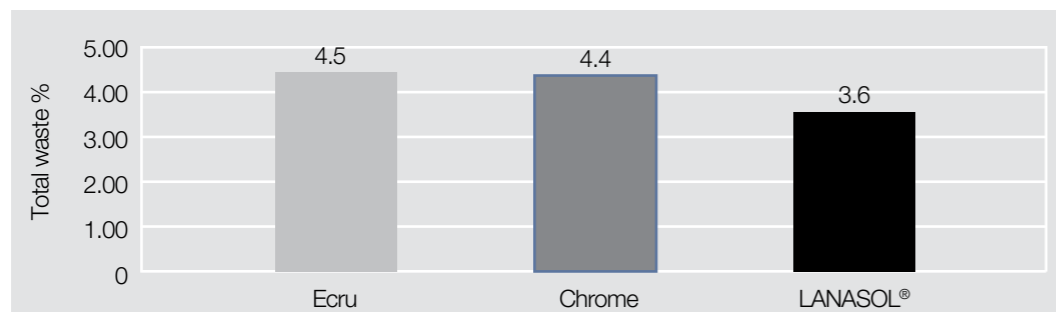
Significant savings/benefits

Savings during spinning



With LANASOL® an end breakage range of approx 85 will require only one operator on one spinning frame. 230 end breaks with chrome dyed wool are impossible to handle for one operator; therefore two operators on one spinning frame with 430 spindles would be required to cope with such a poor spinning batch. To spin 1'000 kgs of 71Nm yarn on 430 spindles takes approx. 11 days (264 hrs).

Savings due to less waste



Assumptions

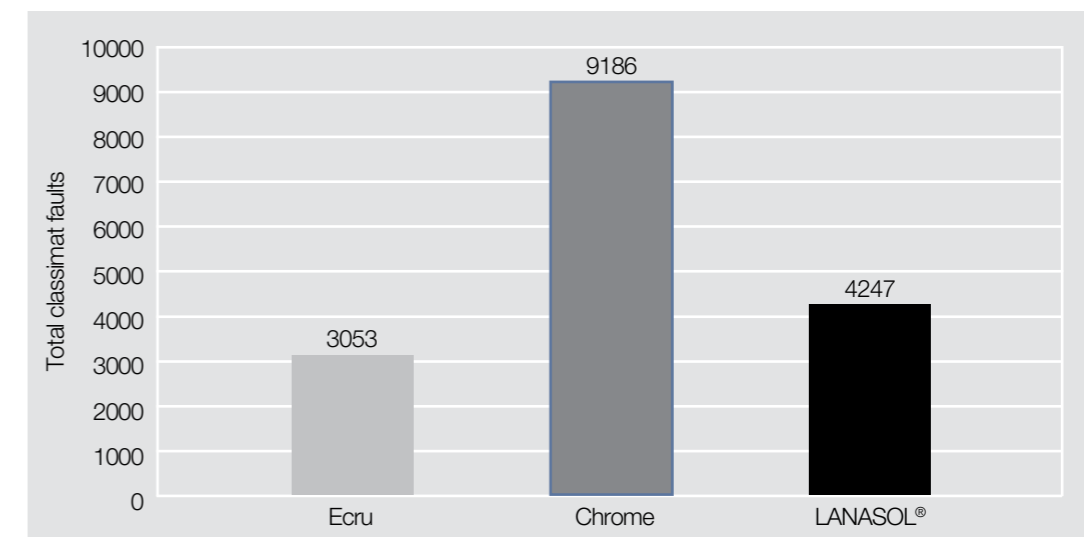
- Top dyehouse**
 - 16 tons/day
 - 220 working days/year
 - 3'520 tons/year
- Spinning**
 - Yarn: Nm 1/71
 - Price: EUR 20.00/kg dyed yarn
- Spinning yield**
 - 95.6% Chrome dyes
 - 96.4 % LANASOL® CE dyes

Result Dyeing with LANASOL® CE produces 28 tons of additional yarn per year which at the going price of 28 USD/kg, **means annual savings of 784.000 USD!**

Auto coner classimat results

Test	Fault class	Ecu	Chrome	LANASOL®
Classimat	A	61	82	17
Classimat	B	11	35	17
Classimat	C	1	7	5
Classimat	D	0	1	0
Classimat	E	0	0	0
Classimat	F	92	500	129
Classimat	G	0	0	0
Classimat	H	2880	8540	4010
Classimat	I	8	21	5

Following on from spinning the classimat results correlate with the single yarn faults as the seriously occurring thick LANASOL® yarn faults (Fault class B) are significantly lower than the chrome dyed yarn. The serious thin LANASOL® yarn faults (Fault class H) are significantly lower than the chrome dyed yarn.



Overall the LANASOL®-dyed lot had 54% fewer faults compared to chrome-dyed lot. With fewer yarn faults to be cleared on the autoconer, machine efficiency and production will be better. Yarns requiring a lot of clearing lead to expensive hold-ups in the production pipeline. Better yarn quality results in better machine efficiency and no bottle necks in production.



For a safer and more prosperous future

A success story

1997 the first 5 LANASOL® CE dyes were launched to initiate the replacement of chrome dyes. This was the start of a success story for customers and their suppliers. 8 new dyes have been added to the range in the last 24 months.

The fastness level of chrome dyes can be reached with a simpler and easier dyeing process.

LANASOL® preserves the original crimp in the wool and its bulkiness. As a result finished fabrics show a more pleasant and soft handle, a more natural luster and a smoother surface.

New exciting products are in the research-pipeline and will further change the area of wool dyeing.

The future is LANASOL® CE!

Chrome dyeing is a dying tradition. No longer do dyers need the high risks and dangers associated with these dyes as deep shades on wool are now more than achievable with the state of the art LANASOL® CE range.

At the same cost you get similar shades and fastness levels with products that are better and safer for all involved from the dyer to the environment. Huntsman Textile Effects with its commitment to sustainability has stopped all production and sales of chrome dyes.

A short recap of the benefits of LANASOL® CE

- Less fiber waste of expensive wool and more yarn yield
- More efficient production from fiber to fabric for higher profits
- Similar fastness level and shade
- Better and safer technique for the environment
- Safer for dyehouse workers in the production mill

The future is LANASOL® CE:

Concern for the Environment
Chrome Exchange
Cost Effectiveness

See it, feel it

You can feel the difference and experience the quality

Excellent results:

Fabric dyed with LANASOL® by



Yünsa Yunlu Sanayi Ve Ticaret
A.S. Sabanci Center Kat 19-20
4. levent 34330
Istanbul / TURKEY

Headquarter

Huntsman (Singapore) Pte Ltd
Textile Effects Division
152 Beach Road
#29-00 Gateway East
Singapore 189721
Telephone +65 6297 3363
Fax +65 6298 0037
pr@huntsman.com

Region Europe

Huntsman Advanced Materials
(Switzerland) GmbH, Textile Effects
Klybeckstrasse 200
4057 Basel, Switzerland
Telephone +41 61 299 11 11
Fax +41 61 299 11 12
pr@huntsman.com

Region Americas

Huntsman International LLC
Textile Effects
4050 Premier Drive
High Point, NC 27265, USA
Telephone +1 800 822 1736
Fax +1 336 819 7440
pr@huntsman.com

Region Asia

Huntsman Textile Effects
(China) Co. Ltd.
Flying Geese Mountain Industrial Park
Shilou Town, Panyu District, Guangzhou
511447, PR China
Telephone +86 20 3937 7000
Fax +86 20 8484 5222
pr@huntsman.com

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