Sustainability in denim

Ideas for savings in water, energy and chemicals

Nearchimica

Denim trends in the news

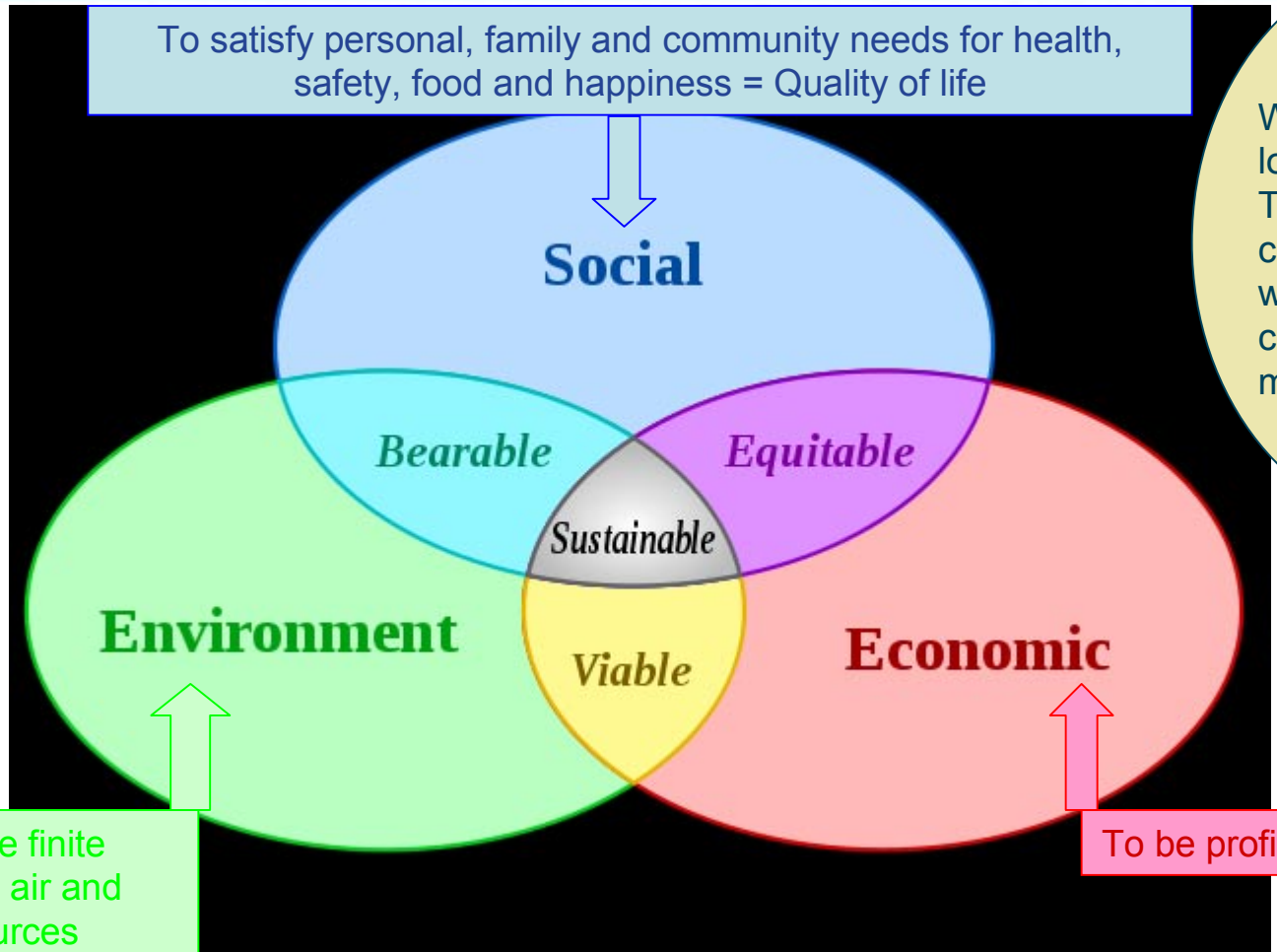
Sustainability has become the Unique Selling Proposition or Unique Selling Point (USP) for many denim jeans manufacturers in the last year or two.

Considering it takes around 1,800 gallons of water to grow enough cotton to produce one pair of blue jeans - not accounting for the amount of water used to reach the appropriate wash– many manufacturers and brands are anxious to tell potential customers what they are doing to make their production of denim more sustainable, with the environment in mind.

New factories are being built with solar panels on the roof to heat water for the bathrooms, exterior walls are covered in vines to absorb radiant heat and keep the building cool, and motion sensors are used to turn off the lights automatically. Wastewater from hand sinks is being used to flush toilets and natural ventilation through windows on opposite ends of the building and through the roof is preferred to air-conditioning.

International brands inform us on hang tags and labels of the efforts they are making to manufacture their jeans in a more sustainable manner.

Sustainability - definition



We seek to balance 3 long-term goals.
The most sustainable choice is the one where the net effects come closest to meeting all 3 goals

The three pillars of sustainability – according to Johann Dréo

Sustainability – definition

Sustainability is the capacity to maintain a certain process or state indefinitely. Sustainability has been expressed as meeting the needs of the present without compromising the ability of future generations to meet their own needs.
An "unsustainable situation" occurs when natural capital (the sum total of nature's resources) is used up faster than it can be replenished.

Sustainability requires that human activity only uses nature's resources at a rate at which they can be replenished naturally.

Production, consumption, technology

In coming to terms with human consumption, sustainability science focuses on four interconnected and basic human resource needs - for:

energy (industry, transport, tools and appliances),
water (agriculture, industry, domestic use),
materials (manufacturing, construction, and
food (horticulture, agriculture and agribusiness.)

Foam Dyeing, Finishing, and Coating

Foam application of process chemicals, or paste coating, in place of conventional systems of dip tanks, sprays, pad mangles, and suction boxes, enables the uniform application of aqueous functional chemistry to cotton fabrics with less than half the water required by conventional systems. Although the technology has been available for many years, major advances in formulation chemistry, foam generation, and application control have been made over the past decade. Foam systems are used for knits and wovens, including denim, for pigment dyeing, finishing, and coating. The low moisture content of the paste or foam coating results in faster drying, enabling a significant increase in production. Because coating places the solution only where required, single-sided or dual-sided applications are possible. For example, in the case of functional finishes, one side of the fabric can be treated to be hydrophobic and the other side to be hydrophilic.

In finishing – what is more sustainable than COATING?

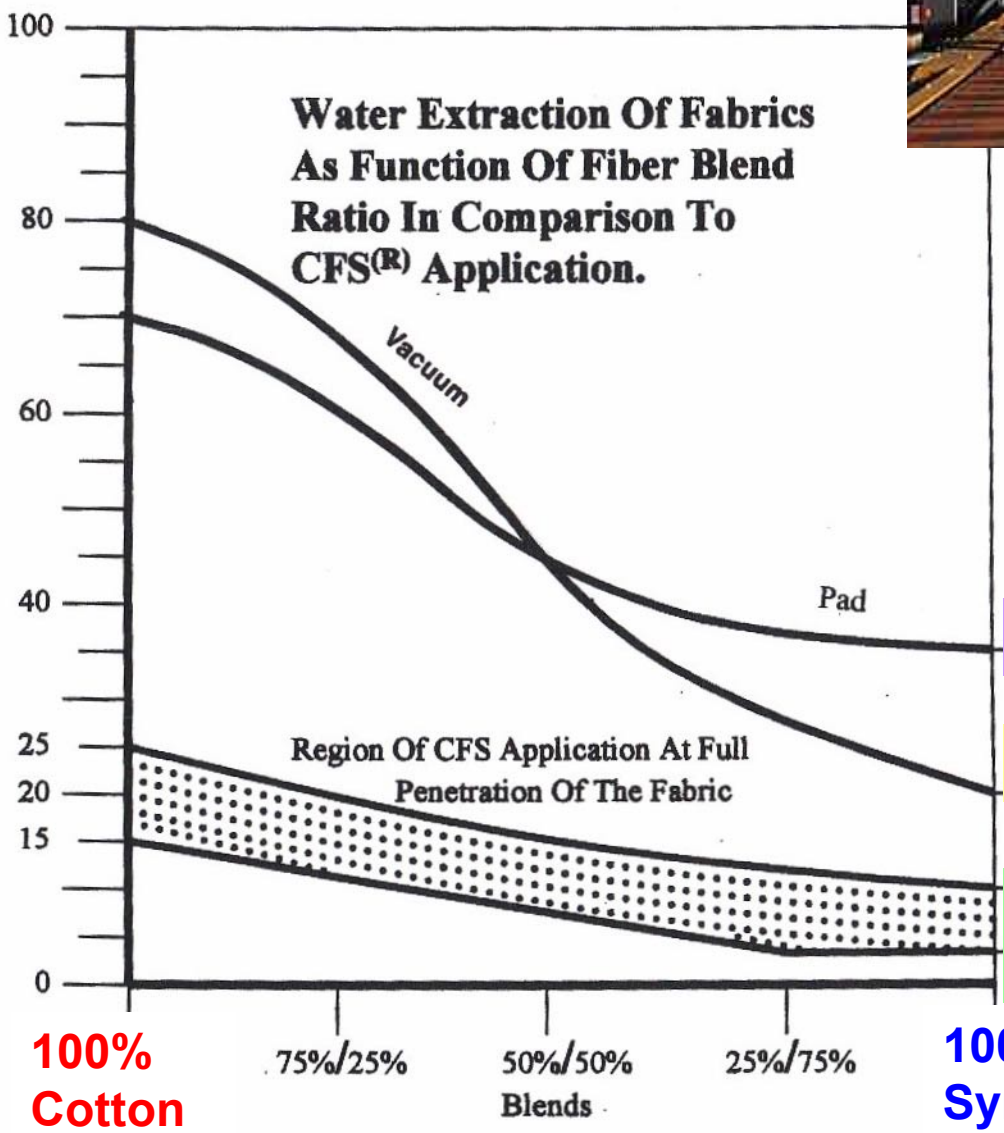
- Significant reductions in **water** and **energy**
- High concentrations – but **reduced consumption of chemicals**
- Minimum use of thickeners
- Precise and controlled liquid feed rates
- Flexibility in chemical applications
- Measurable **reductions in waste** volumes with **zero discharge** possibilities
- Reduced **air** pollution
- Rapid wetting and penetration –high machine speeds/productivity

Less water to be dried

Vacuum – 80%

Pad – 70%

CFS foam coating – 15 to 25%

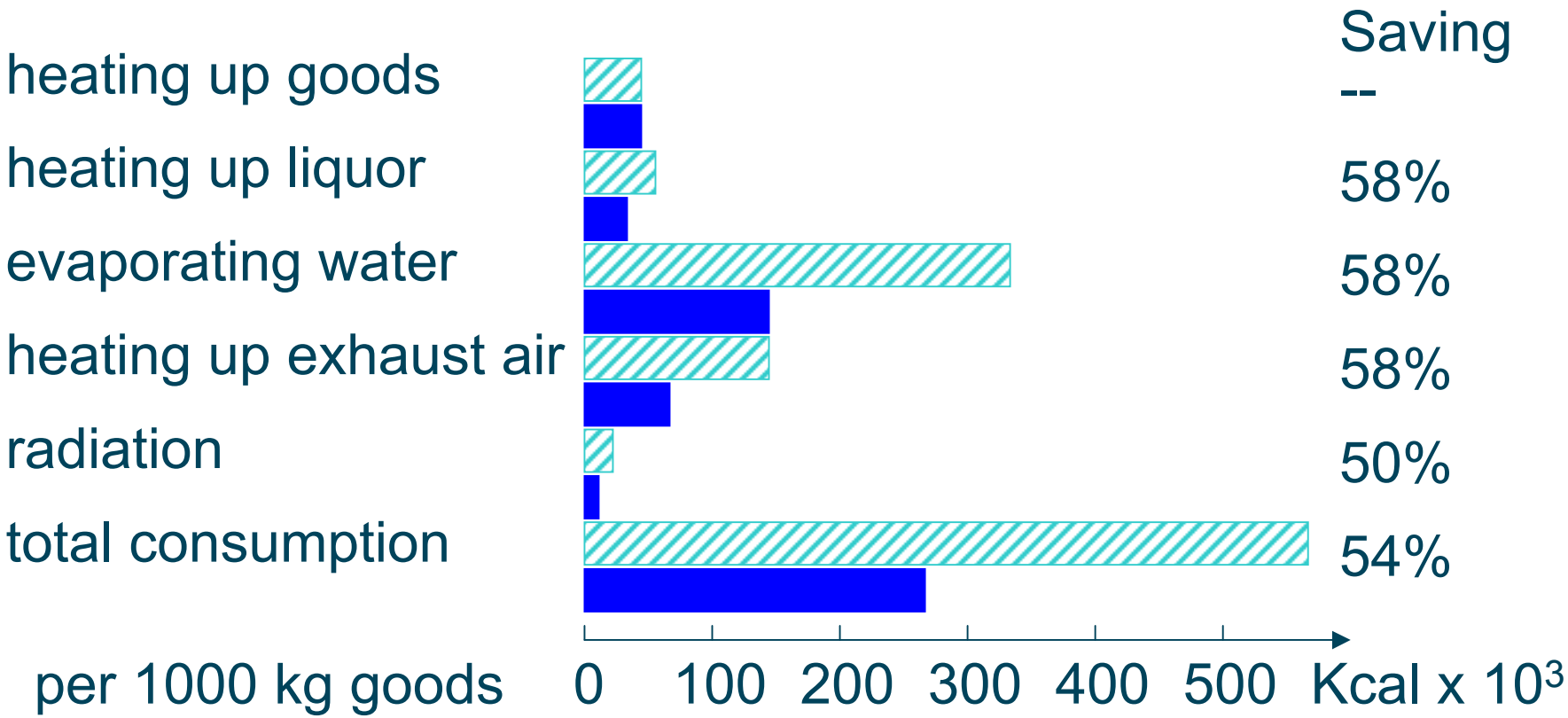


Pad – 35%

Vacuum – 20%

CFS foam coating – 3 to 10%

Energy consumption in drying



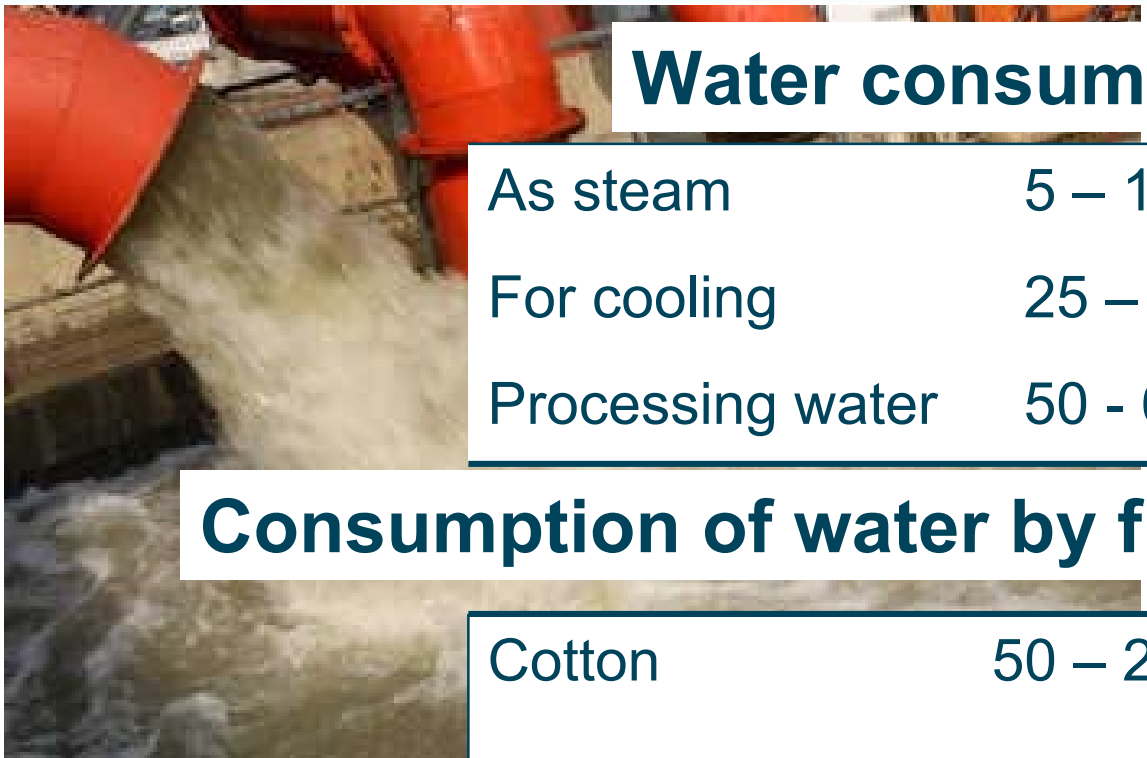
pad mangle (65% pick-up) versus low add-on (30% pick-up)

Thirsty cotton

Cotton is one of the thirstiest crops grown by man, along with rice, sugar and coffee. Compared with the amount of water we consume directly, what is required to feed and clothe us is quite staggering

Personal domestic water consumption in Europe, drinking, washing, flushing toilet	150 litres per day
To grow 1 kg rice	1900 litres
To grow 1 kg wheat	900 litres
To grow 1 kg sugar	1500 - 3000 litres
Water to grow feed for a cow to produce milk for 1 kg cheese	5000 litres
To grow 1 kg coffee	20,000 litres
To grow 1 kg cotton To manufacture 1 cotton T-shirt	7000 – 29,000 litres 970 litres

Consumption of water in textile finishing



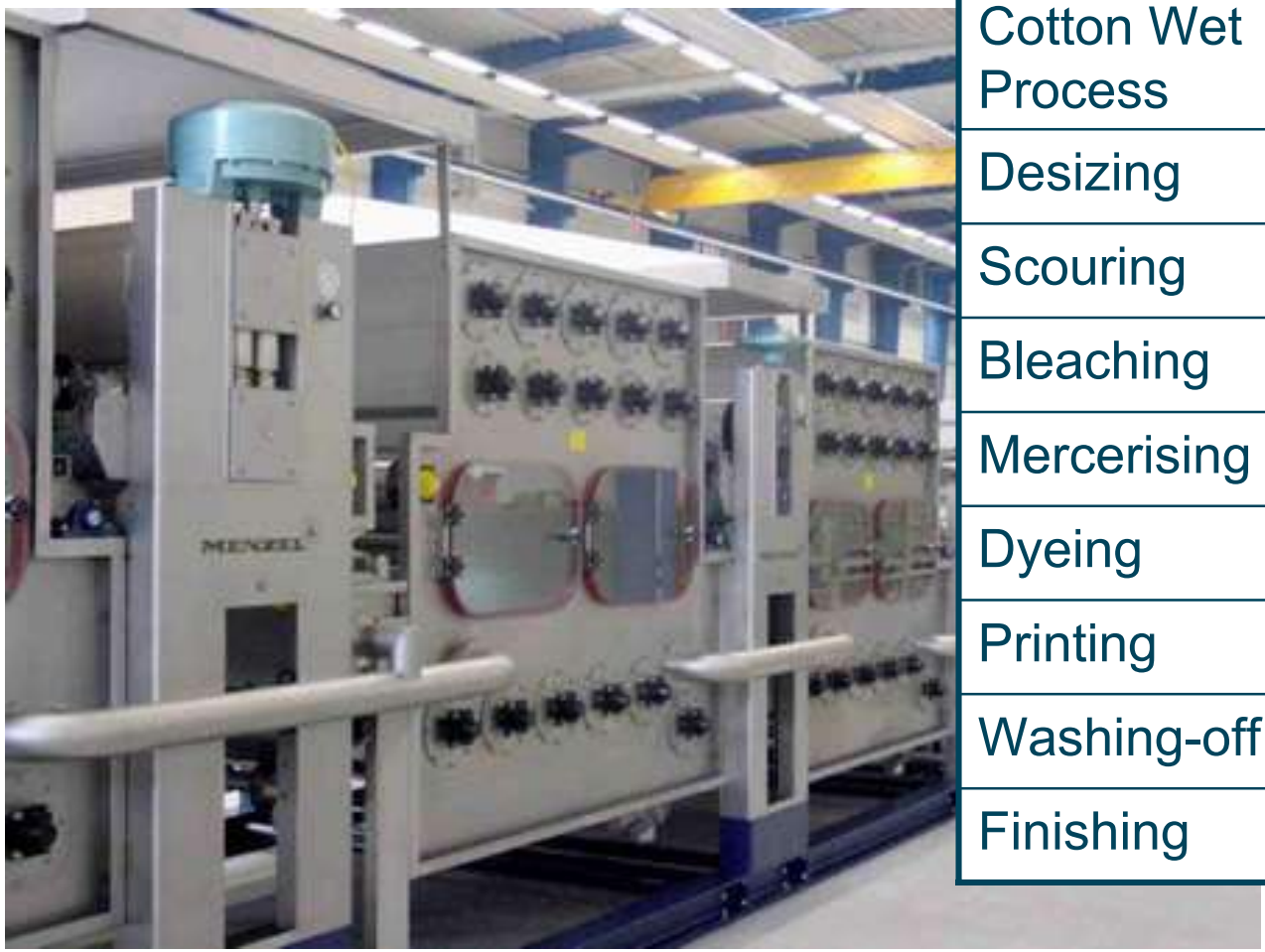
Water consumed / %

As steam	5 – 10
For cooling	25 – 35
Processing water	50 - 60

Consumption of water by fibre – litres per kg

Cotton	50 – 200
Wool	75 – 300
Synthetics	10 - 100

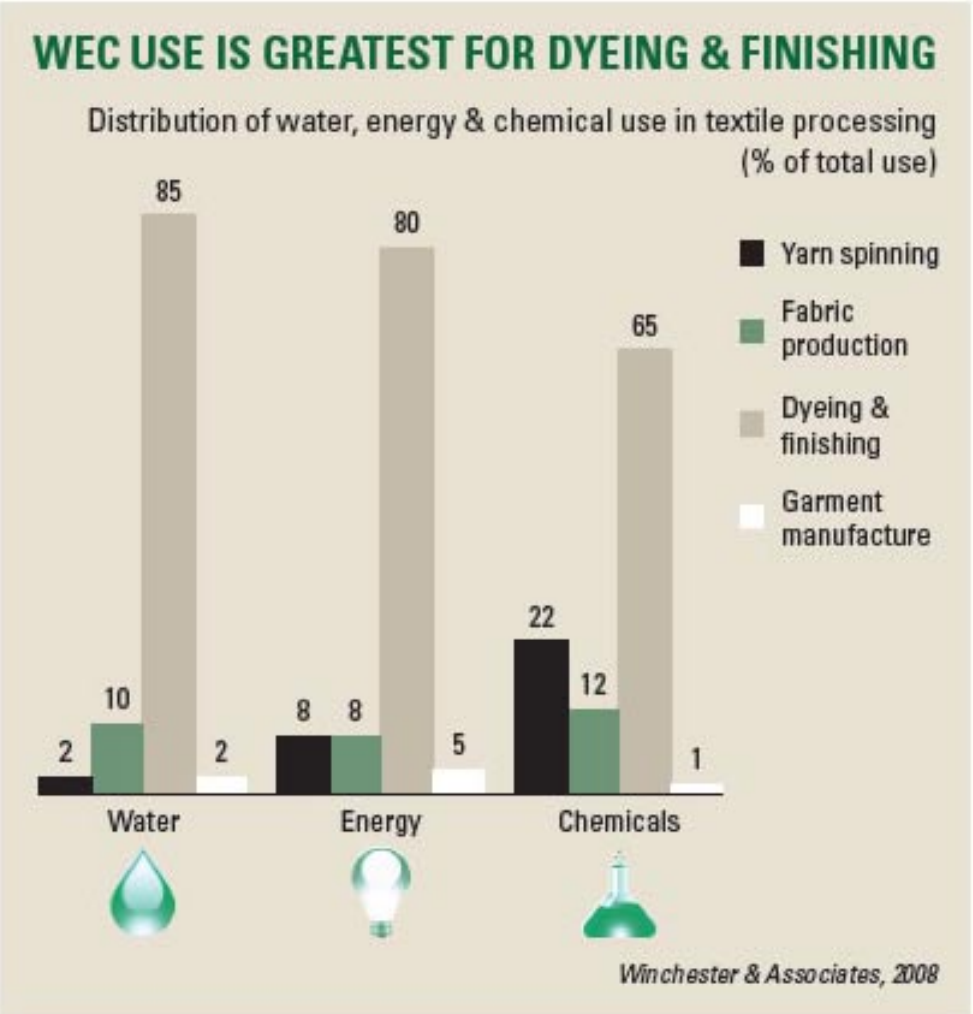
Consumption of water in cotton finishing



Cotton Wet Process	Water consumption litres/kg
Desizing	20
Scouring	4
Bleaching	180
Mercerising	7
Dyeing	30
Printing	25
Washing-off	110
Finishing	5

PRE-TREATMENT

Use of water, energy, and chemicals (WEC) in cotton textile processing



Water

In production of denim jeans, combining two or more processes into one can significantly cut water consumption:

For example:

NEARSTONE N30 STONEWASH + NEARBLEACH ECO LT in the same bath
Saves at least 30 L. per kg (2 rinses at L.R. 1:10 + bleach L.R. 1:10) and processing at room temperature throughout saves energy.

SOFTENING WITH NEARFINISH ECO FAST + STONE WASHING IN 1 BATH
Saves 30 - 50 L. per kg of garments (bio-polishing L.R. 1:10 + rinse L.R. 1:10)

NEARFINISH ECO-FAST

NEARFINISH ECO-FAST is a new silicone softener with remarkable stability which offers several ways to combine treatment baths and thus save water, energy and chemicals.

- Save up to 50 litres of water for every pair of jeans
- Reduce utility costs and energy usage
- Assists in marketing of 'sustainable' denim garments

NEARFINISH ECO-FAST can be added to:

- ➢the desizing bath – compatible with detergents and alkali
- ➢the enzymatic abrasion bath – compatible with cellulase enzymes
- ➢and has the potential to reduce anti-backstaining agent, and reduce or eliminate desizing enzyme

Conventional processing of 100 kg denim jeans uses 11-15000 litres of water

Desizing 1000 L | Rinsing 2-4000 L | Stone Wash 1000 L | Rinse Bleach Neutralise Rinse Soften 7 - 9000 L | TOTAL WATER 11-15 000 L

NEARFINISH ECO-FAST used in desizing only with detergent , and stone washing with neutral cellulase NEARSTONE N30 100kg denim jeans

Desizing 1000 L | Rinse Bleach Neutralise Rinse Soften 7 - 9000 L | TOTAL WATER 8-10 000 L

Saving 3 – 5000 L WATER

NEARFINISH ECO-FAST Process

Conventional process flow

ECO-FAST process flow

Conventional process

Water 1000L	Time mins	Temp ° C	Chemicals % o.w.g.		
1	14	45-60	Detergent 0.2 – 0.3	Desizing	Desizing + Abrasion
2 - 4	9	20-30		Rinse	
1	34-64	45-55	Neutral enzyme 0.5 – 1.0	Abrasion	
2 - 4	9	20-30		Rinse	Rinse
1	9 -19	40-50	Sod. hypochlorite	Bleaching	Bleaching
1	9 -14	45	Hydrogen peroxide or bisulphite	Antichlor	Antichlor
2	9	20-30		Rinse	Rinse
1	9	20-30	Softener	Soften	Soften

Nearfinish ECO-FAST process

Chemicals % o.w.g.	Temp ° C	Time mins	Water 1000L
Detergent 0.2 – 0.3 **NEARFINISH ECO-FAST** 0.3 –1.0% NEARSTONE N30 0.5 – 1.0	45-55 45-55	12 32-62	1
	20-30	9	2 - 4
Sod. hypochlorite	40-50	9-19	1
Hydrogen peroxide or bisulphite	45	9-14	1
	20-30	9	2
Softener (if needed)	20-30	9	1

Water	Time
11-15,000 L	102 – 147 mins

TOTAL

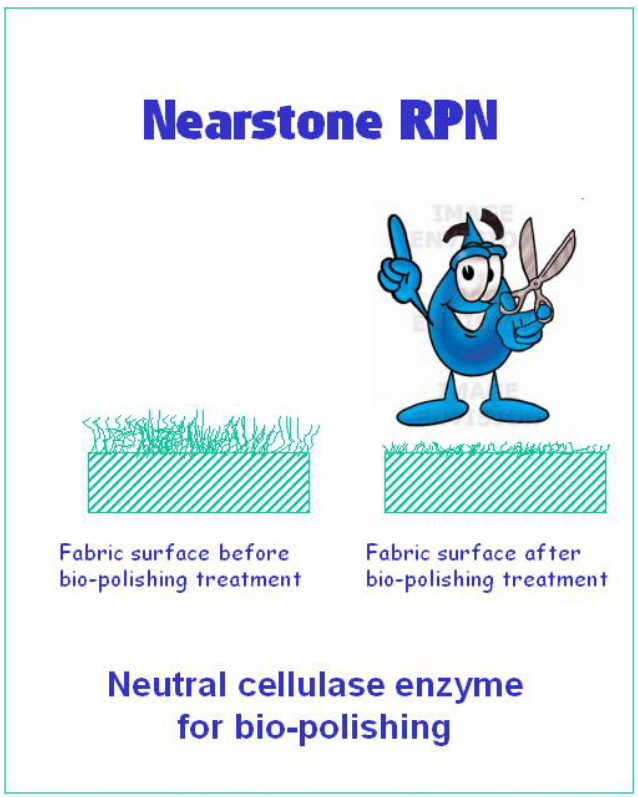
Time	Water
89 – 134 mins	8 – 10,000 L

SAVING →

9 – 13 %	27 – 33 %

NEARSTONE RPN

NEARSTONE RPN is a NEUTRAL cellulase enzyme used for Bio-Polishing.



Being a NEUTRAL cellulase, but just as effective in bio-polishing, NEARSTONE RPN may be used in the same bath as dyeing with direct dyes, dyeing with reactive dyes or dyeing with pigments..

DIRECT DYEING + BIO-POLISHING Saves 20 litres/kg
(1 X bio-polishing bath L.R. 1 : 10 + 1 X rinse bath L.R. 1:10)

REACTIVE DYEING + BIO-POLISHING Saves 20 litres/kg
(1 X bath bio-polishing L.R. 1:10 + 1 X rinse bath L.R. 1:10)

PIGMENT DYEING + BIO-POLISHING Saves 20 litres/kg
(1 X bio-polishing bath L.R. 1:10 + 1 X rinse bath L.R. 1:10)

Chemicals

Sodium hypochlorite may be used in bleaching, or potassium permanganate may be sprayed to discharge the indigo, producing a vintage effect.

Garment processing

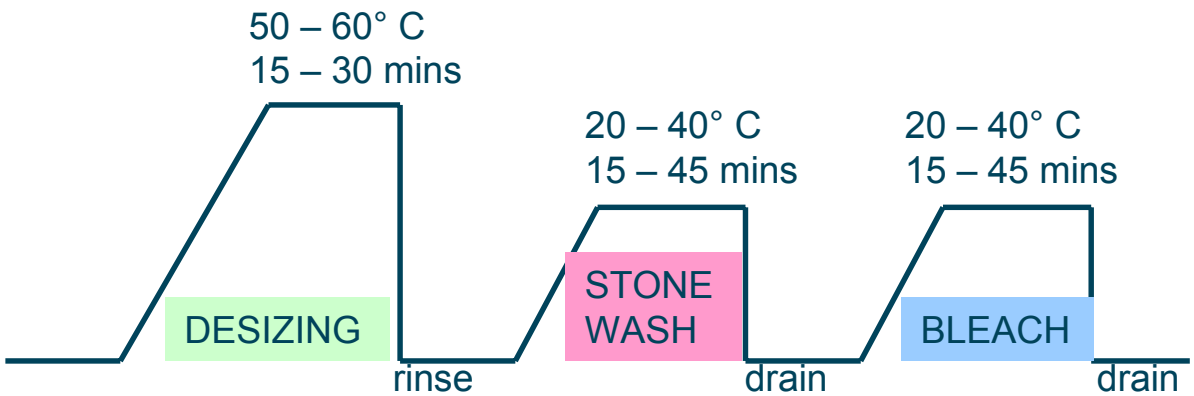
Speciality chemicals have been developed to achieve similar effects without use of potassium permanganate or chlorine.

NEARBLEACH ECO LT

NEARBLEACH ECO LT is a new laccase enzyme, and a new type of mediator, which contributes to improved sustainability in processing of denim garments. **NEARBLEACH ECO LT** enables the creation of new vintage looks at room temperature, and may be applied in the same bath used for stone washing, so saving energy and water, and replacing corrosive chemicals such as potassium permanganate and sodium hypochlorite.

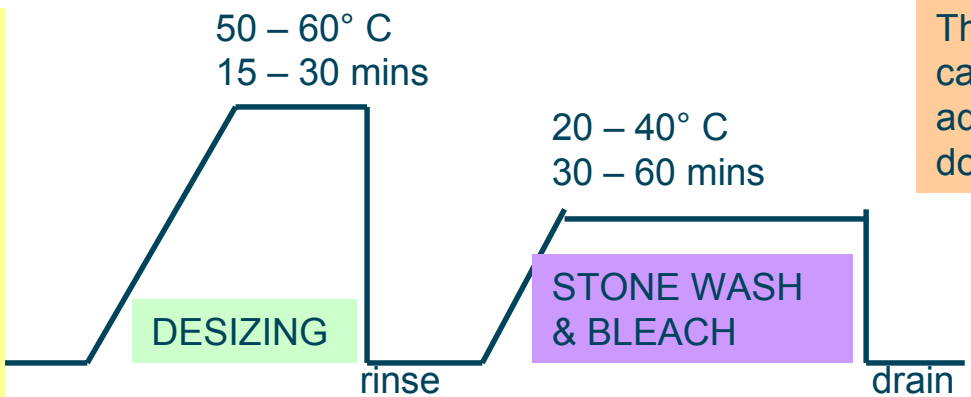
Two Step method

After the stone wash abrasion cycle, the bath is drained and refilled, followed by enzymatic bleaching with NEARBLEACH ECO LT



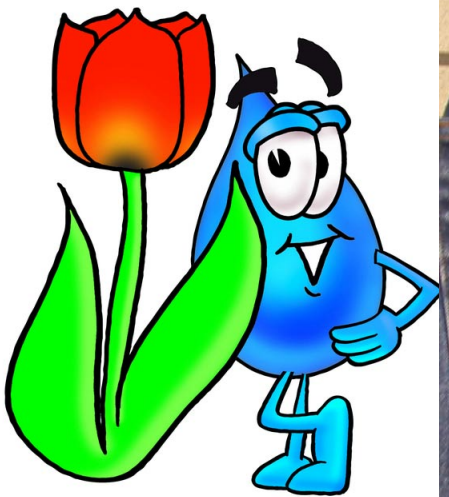
One Step method

Stone wash, for example with NEARSTONE N30 cellulase and shade adjustment with NEARBLEACH ECO LT can be combined in one bath at low temperature.



The right shade and cast is achieved by adjusting the time and dosage of enzymes

NEARBLEACH ECO LT



Energy

Desizing at low temperature

NEARZIM 610 is an alpha amylase enzyme active at 40° C, but we can also provide enzyme to function at 20° C if this is practicable under your factory conditions.

NEARSTONE N30

NEARSTONE N 30 is a neutral cellulase designed to work at low temperature (20-40° C).

1. STONE WASH PROCESS – GUIDE RECIPES

	1	2	3	4	5
NEARSTONE N 30	2.5 %	1 %	1 %	0.5 %	0.5 %
Pumice stone	-	30 %	50 %	80 %	100 %
NEARISERVE D-SW	1 g/l	1 g/l	1 g/l	1 g/l	1 g/l
Duration of treatment	60 minutes				
Liquor ratio	1 : 5				
Temperature	35° C ± 2° C				

NEARISERVE ECO PEARL

Anti-backstaining agent
NEARISERVE ECO PEARL
100% active in pearl form is readily soluble at 30° C.

Ozone Bleaching

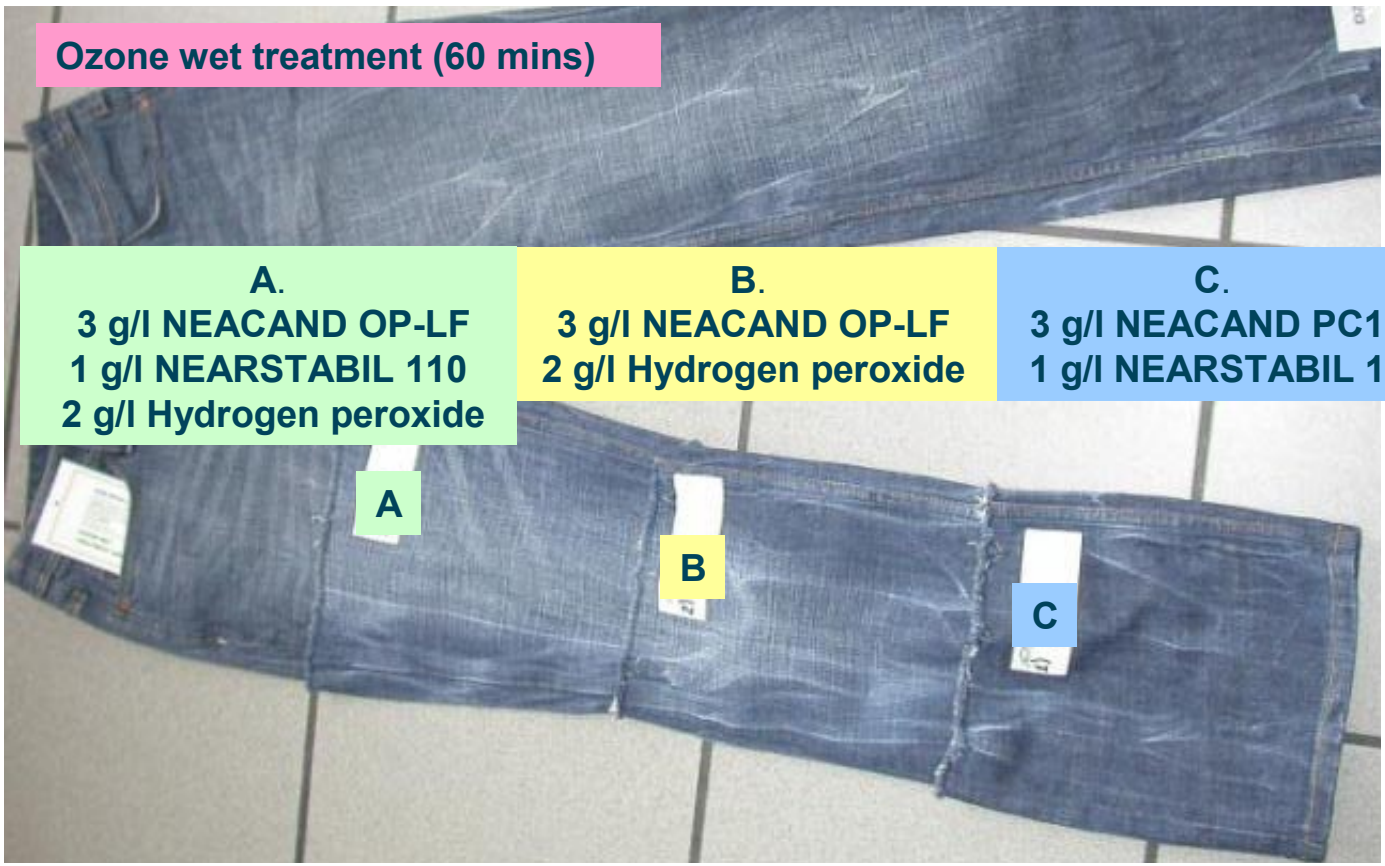
When you think “ozone” you might think “water purification,” but in textiles, ozone has found other niches. In addition to low-temperature disinfecting in commercial laundries, ozone is used in garment washing processes to reduce chemicals used to achieve wash-down looks, and to decolourise waste water, so that any dye going into the effluent stream is decolourised before discharge. Ozone is an appealing technology to explore because as a powerful oxidizer it works very quickly; it uses significantly less water than some conventional garment washing processes; it works best in a chemical free bath; and it’s effective at room temperature. Says Len Farias, senior textile chemist at Cotton Incorporated, “We’ve been using ozone technology to process cotton fabrics. We can get a very similar wash-down effect as we could with bleach, stones or even enzymes. Ozone is environmentally benign: There are no chemicals involved other than the ozone, and when it decomposes it turns back to free oxygen, which is very environmentally friendly.”

With ozone bleaching, the moisture content of the jeans will influence the bleaching effect achieved; all precautions possible should be taken to maintain the moisture content more constant whilst garments stand around waiting for treatment with Ozone, preventing or retarding premature or uneven drying out.

Greyish cast in Ozone bleaching

A feature of ozone bleaching that is sometimes thought to be a disadvantage, is the greyish cast with which it leaves the denim.

Different treatments following ozone wet treatment can give a bluer, brighter shade.



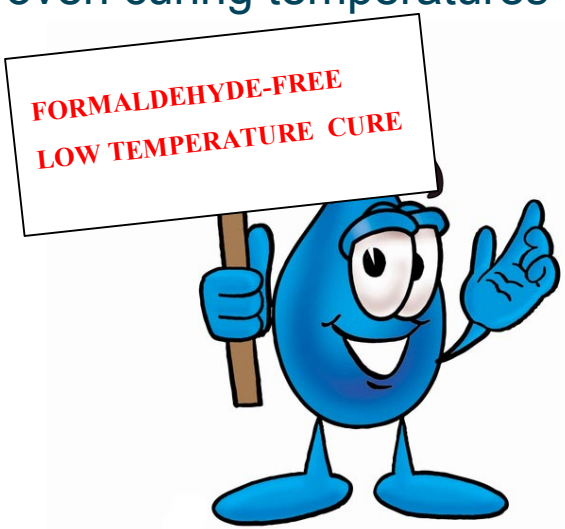
Cold Pigment Dyeing

NEARCHIMICA offers several systems for cold dyeing with pigments on different fibres

NOFELDING LN-FC

NOFELDING LN-FC is a formaldehyde-free integrated resin and catalyst system for easy-care finishing of cellulosic fabrics, and wrinkle fixing on made-up garments at low curing temperatures.

3D effects, whisker and wrinkle-fixing, can be achieved with oven curing temperatures of only 100° C.



NEARFINISH HPU

NEARFINISH HPU is a special product based on polyurethane resin, recommended to give permanent wrinkles on denim.It differs from ordinary glyoxalic resins because it ***does not affect cellulose resistance*** and its final dyeability. It is therefore often used to fix wrinkles on lightweight denims without affecting the tear strength.