



**Denim Jeans  
Wet Processing**

*June 2005*

**Tri Tex**

**Co Inc.**

**Your partner in jeans wet processing.**

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## TRI-TEX LABORATORIES: THE SCIENCE OF COLOR.

Tri-Tex maintains three technologically advanced on-site laboratories, each working in specific areas of expertise, while contributing to our overall mission of optimizing product quality, performance and process control.

Testing is on-going, as part of the system wide quality control program and particularly in research and development work. If there's new technology or information out there on dyes, pigments, or auxiliary products, our chemists and skilled technicians know about it and are working on ways to apply it to your industry.



*Tri-Tex commitment to R & D leads the way in new or better products for the industry.*

## TRI-TEX QUALITY CONTROL: THE SCIENCE OF SATISFACTION.

From the laboratory, through production, right through to the loading bay, Tri-Tex commitment to product quality is evident. Testing and product performance follow-up is designed to ensure a consistency of quality that clients in Canada and around the world have come to trust.

If you ask us to blend the color of an orchid, we will. If you ask us to do it on cotton, polyester, acrylic or any other fabric, we will. And if you ask us again, in 2 months or ten years, for 2 batches or 2,000, Tri-Tex will come through with the same true color or auxiliary product. Guaranteed.



*Industry-wise chemists and technicians consult with clients to develop cost-effective, customized solutions.*



## Tri-Tex Product Line for Jeans Wet Processing

### *DESIZING AGENT & DELINERS*

| Product Name              | Description  | Ionicity |
|---------------------------|--|----------|
| <i>Jean Strip 250 NPF</i> | Pre-wash combined product containing detergent and amylase.            | N        |
| <i>Jean Strip ATL</i>     | Pre-wash combined product containing detergent, wetting and lubricant. | N        |
| <i>Jean Strip DL</i>      | Pre-wash lubricant and amylase that prevents lines and back staining.  | A        |
| <i>Jean Amylase HT</i>    | Amylase enzyme used in pre-washing and desizing.                       | A        |

### *ANTI-BACK STAINING AGENTS*

| Product Name                | Description  | Ionicity |
|-----------------------------|--|----------|
| <i>Jean Clear 2000</i>      | Economical anti-back staining agent for denim washing for cotton and blends.   | A        |
| <i>Jean Clear Plus</i>      | Very effective anti-back staining agent for additional whiteness in poly cotton blends pocketing and polyester labels. | A        |
| <i>Jean Clear ECO</i>       | Pre-wash agent and desizing aid used in denim wet processing providing minimal back staining and low BOD in effluents. | A        |
| <i>Jean Clear 1233</i>      | Polymer based anti-back staining agent design to produce clean background and reduce back staining on polyester.       | N        |
| <i>Jean Clear CJ Powder</i> | Concentrated and anti-back staining agent specially designed to prevent staining of indigo on cotton.                  | N        |

### *LUBRICANTS*

| Product Name         | Description   | Ionicity |
|----------------------|---|----------|
| <i>Tricolube JSA</i> | Polymeric lubricant specially designed to prevent lines during denim garment washing. | N        |

### *BUFFERS*

| Product Name                   | Description  | Ionicity |
|--------------------------------|--|----------|
| <i>Jean Buffer AC-50 Conc.</i> | Buffer for acid and hybrid cellulase enzymes, gives a pH of 5. | N        |
| <i>Jean Buffer NEU</i>         | Buffer for neutral cellulase enzymes, gives pH of 6.5.         | N        |



### **ACID ENZYMES**

| Product Name                   | Description  | Ionicity |
|--------------------------------|--|----------|
| <i>Jean Cellulase ABE Pdr.</i> | Granular pre-buffered acid cellulase. Low backstaining.  | N        |
| <i>Jean Cellulase ASF Liq.</i> | Highly effective economical low back staining acid cellulase giving maximum abrasion and contrast. | N        |
| <i>Jean Cellulase LC-8</i>     | Liquid enzyme preparation for rapid abrasion of denim garment                                      | N        |

### **NEUTRAL ENZYMES**

| Product Name               | Description   | Ionicity |
|----------------------------|---|----------|
| <i>Jean Cel NLB-4 Liq.</i> | New neutral enzyme giving maximum abrasion and maximum contrast with minimum strength loss. | N        |
| <i>Jean Cel NPE Pdr.</i>   | Granular pre-buffered neutral cellulase, low backstaining, high contrast.                   | N        |

### **HYBRIDE ENZYMES**

| Product Name               | Description   | Ionicity |
|----------------------------|---|----------|
| <i>Jean Cel HLB-2 Liq.</i> | Hybrid enzyme giving maximum abrasion and maximum contrast with minimum strength loss.                | H        |
| <i>Jean Cel AEP-1 Pdr.</i> | Concentrated hybrid powder enzyme for cost effective abrasion of denim garment with maximum contrast. | H        |

### **LACCASE ENZYME**

| Product Name        | Description   | Ionicity |
|---------------------|---|----------|
| <i>Trilite II</i>   | Granular laccase enzyme for the discoloration of indigo dyes. | A        |
| <i>Trilite Plus</i> | Extra powerful concentrated laccase enzyme blend              | A        |

### **ENZYMES FOR BIOPOLISHING**

| Product Name                 | Description  | Ionicity |
|------------------------------|--|----------|
| <i>Tricellulase ASF Liq.</i> | Economical cellulase for bio polishing                           | N        |
| <i>Tricellulase CD Liq.</i>  | Highly effective economical enzyme for bio polishing 100% cotton | N        |

### ***SOFTENERS***

| Product Name                | Description  | Ionicity |
|-----------------------------|--|----------|
| <i>Jean Soft CWS Flakes</i> | Water soluble softener flakes.                           | C        |
| <i>Jean Soft CWS Liquid</i> | Economical cationic softener in liquid form.             | C        |
| <i>Jean Silk LEA new</i>    | Very efficient silicone softener for a maximum softness. | N        |
| <i>Jean Silk DEL</i>        | Silicone softener, stable to shear effect.               | N        |

### ***CHLORINE & PERMANGANATE DEACTIVATOR***

| Product Name           | Description   | Ionicity |
|------------------------|---|----------|
| <i>Jean Reduct PPN</i> | Very efficient potassium permanganate and chlorine deactivator. | N        |

### ***PRODUCT LINE FOR JEANS SPECIAL EFFECTS***

| Product Name                    | Description  | Ionicity |
|---------------------------------|--|----------|
| <i>Jean Tex ATM</i>             | Antimigrant to be used with permanganate in spray system.  | A        |
| <i>Jean Coat PU6</i>            | Film forming polyurethane emulsion used to create special effects by spraying on garments. Also for use as a pigment binder. | C        |
| <i>Tritone Softeners Series</i> | Excellent softening agent for denim wet processing. Available in various colors for light tinting.                           | C        |
| <i>Magic Wash MJ</i>            | Powder oxidant to create a wash down look effect on garments dyed with reactive or direct dyes.                              | N        |
| <i>Tricofresh LOC</i>           | Glyoxale resin for three dimensional cat whiskers  | N        |
| <i>Jean Protect MTL</i>         | Protects buttons and zippers from oxidation.   | A        |
| <i>Jean Control ALK</i>         | Highly concentrated liquid alkali that provides pH control in multiple purposes (Buffering, neutralizing, etc.)              | ***      |
| <i>Jean Reduc DX</i>            | Dextrose based reducing agent designed to reduce indigo dye on the garment and also in the bath.                             | ***      |
| <i>Jean Tints</i>               | Highly effective coloring system to produced fast tints by spraying. Used in combination with Triactivator R.                | A        |
| <i>Triactivator R</i>           | Activator for Tritint R dyestuffs.   | ***      |

*Ask your sales representative for technical information on all these products.*

## Denim Jeans Wet Processing

Garment processing has greatly evolved over the past twenty years. For example, the denim jeans of the past were worn in a rigid, starch-finished form. Now fashion requires that we run them through various methods of conditioning, like desizing, enzymatic stonewashing with or without abrasive, decolorization, neutralization, brightening and finishing. In this booklet we will illustrate the action of each product for the garment wet processing of jeans.

### Who's Making Denim

There are many denim manufacturers and consequently many different styles and quality of denim available on the market. In Canada, Swift Denim is an important name. In the United States, Cone Mills and Burlington Global Denim are leading manufacturers of jeans fabric.

The company **Swift Denim** was founded in 1882 in the city of Columbus, Ga.. Today it's supplying major customers like Levi Strauss, Vanity Fair and Tommy Hilfiger.

**Burlington Global Denim** has plants in the US and India, and has completed another in Mexico in 1999. Burlington expects further international partnerships to expand their full package program, which goes from a bale of cotton to laundered jeans ready for retail.

Founded over a century ago, **Cone Mills** is the world's largest producer of denim and ring-spun denim. It is also the largest exporter of apparel fabrics, with export sales comprising 26% of its total sales. Cone has representatives covering 40 countries, including the US, Mexico, Brussels and Singapore.

### Who's Making Jeans

This question is the easiest to answer, as all we have to do is turn on the television set. This is the most public aspect of the jeans construction process, and the one with names that we remember readily and that are well known across North America and other parts of the world.

**Calvin Klein** has recently extended its lucrative jeans wear and sportswear industry with an underwear brand. The recent relaunching of Calvin Klein's original white label/dark denim jeans, as well as its extensive lifestyle-oriented jeans wear collection, give this company a strong future.

Founded in 1978, **Diesel** jeans offers 12 unisex fits in bottoms with a huge variety of washes, as well as a full men's and women's range of sportswear, active wear and accessories.

**Edwin** explores the area of alternative fabrication with its hemp and wool-cotton blends, as well as its standard Japanese double ring spun denim.

**Lee** jeans, founded in 1889, have a multi-generational market in denim and twill bottoms, and also features a complete line of casual shirts and jeans jackets.

Celebrating its 125th anniversary, **Levi Strauss & Co.** tells us to "expect the unexpected". Levi's Vintage Line as well as the increased focus on its Silver Tab collection and the move into selling shoes, jackets and leather goods, can only promise more innovation.

**Polo Jeans** offers a full jeans wear and sportswear collection despite its recent launch two years ago. The brand also gives new sophistication with selvage, leather jeans and black denim.

## **Biochemical Structure of Cellulose**

Cellulose has a simple chemical structure: it's composed of one long polymer of glucose, with an average of 3 units of glucose per polymer. The monomers of sugar are linked to one another by something called *beta-1,4*, which has an opposite configuration to starch, which is defined as *alpha-1,4*.

The structural difference between the alpha of starch and the beta of cellulose can seem unimportant, yet this small natural difference in the polymers gives them very different physical, chemical and even nutritional properties. The amylase enzymes, which naturally degrade starch, cannot break down cellulose, while the cellulase enzymes cannot break down starch.

## **Cellulase Basics**

Cellulase is formed naturally to degrade cellulose into sugar. Cellulase is a natural mixture of up to 15 different components or activities. The aggressiveness of cellulase is related to:

- The presence of certain components.
- The characteristics of these components.
- The relative quantity of these components.
- The conditions of use: time, temperature, pH, type of machinery, liquor ratio and fabric load.

## **Cellulase History**

Aggressive cellulase is found in nature, and obtained from *Trichoderma*. A less aggressive cellulase can be obtained from *Humicola*, individual components are also produced from it.

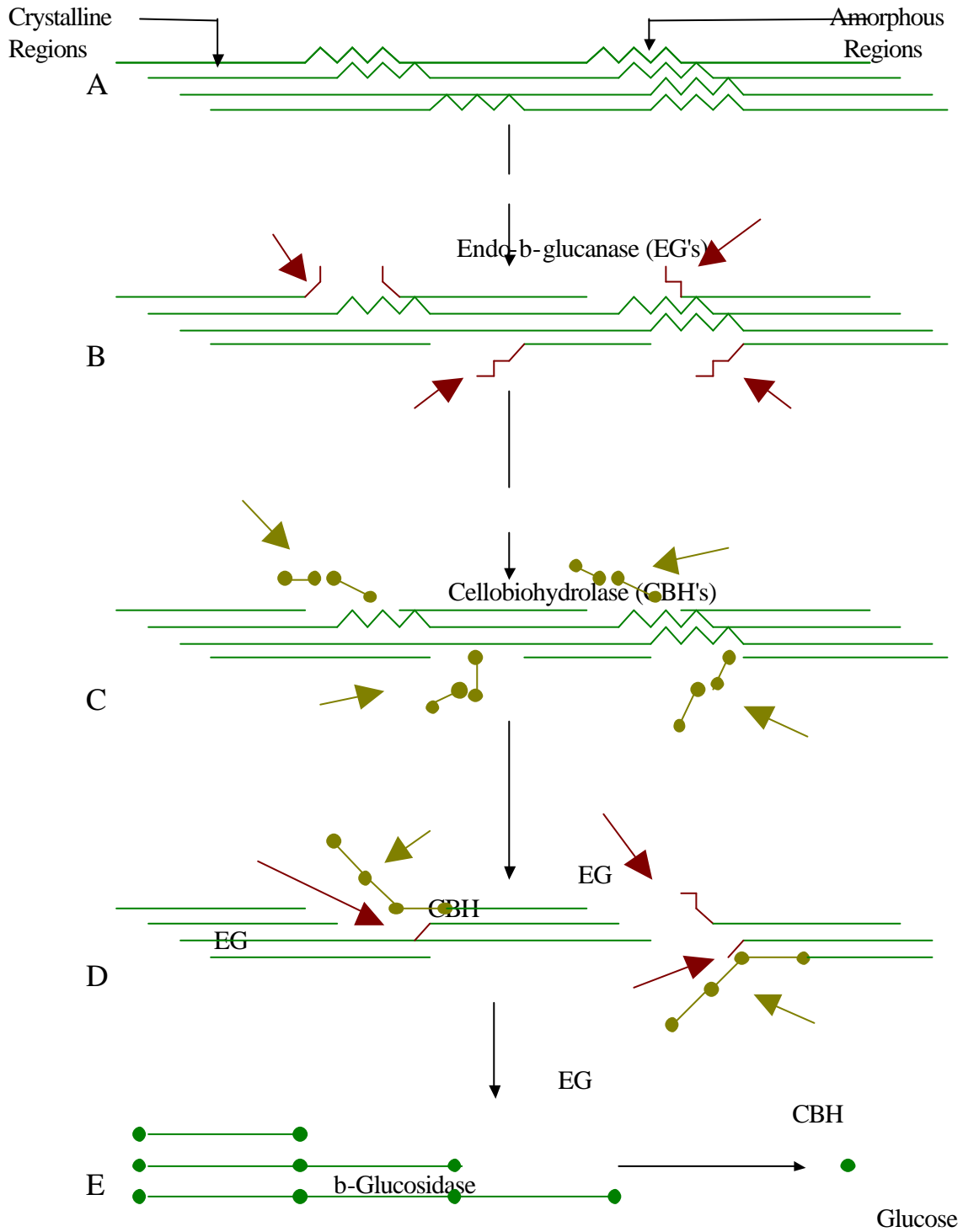
## **Use of Cellulase on Cotton**

The bio-degradation of cellulose cannot occur without the action of a family of enzymes called the *cellulases* and the *glucanases*. Cellulase isn't a single enzyme, but is actually a complex multi-enzymatic system, produced and secreted by certain microorganisms such as bacteria, yeast and fibrous mushrooms. The result is a diverse mix of enzyme activity that acts in different ways on cellulose fiber.

Cellulasic enzymes can attack cellulose in two different ways: *Endocellulases* hydrolyze the  $\beta$ -1,4 link by randomly cutting the inside of the cellulose polymer, and consequently converting crystalline cellulose to amorphous cellulose. *Exocellulases* cut the extremities of the polymer. The most important exocellulases are the *cellobiohydrolases* which detach two units of glucose at a time, thus leaving *cellobiose*, which is equivalent to maltose in the case of amidon. The last type of enzyme present in cellulase are called *cellobiases*, which hydrolyze the cellobiose to produce glucose. This action is demonstrated on the schematic on next page.

The fibrous mushrooms *Trichoderma* are one of the best-known producers of cellulase, and are used for the industrial production of these enzymes. However, only certain selected batches produce the appropriate mixes of exo and endo cellulases that can be effectively applied to the textile industry.

## Schematic Representation of Synergistic Action of Enzymes on Cellulosics







## Enzymes in the Textile Industry

- Amylases:** For low temperature desizing processes, for medium to high temperature desizing, and for high temperature continuous desizing processes.
- Cellulase:** For bio-polishing and denim finishing.
- Protease:** For wool finishing.
- Catalase:** For bleach cleanup.
- Laccase:** For discoloration of indigo dyes.

### Alpha-Amylase

The first procedure for jeans processing is the pre-wash. The purpose of this step is to remove the starch and a portion of the indigo dye from the jeans. This significantly softens the denim and during later steps will prevent streaks from forming because the material was too hard.

The problem of streaks on the finished garments can generally be traced back to the desizing step. Initially the denim is stiff, and during packing and transportation, the garment becomes pressed and distinct creases are formed. If the garment is abraded while still stiff, streaks can form along the creases because these surfaces are more exposed. That's why it is very important that the denim fabric is softened by the complete removal of size.

In this operation the starch present in the fabric is hydrolyzed by an alpha -amylase enzyme and turned into soluble dextrin. In the past, pre-washes were performed with jeans turned inside out, which were then cleaned with hot water and a good detergent.

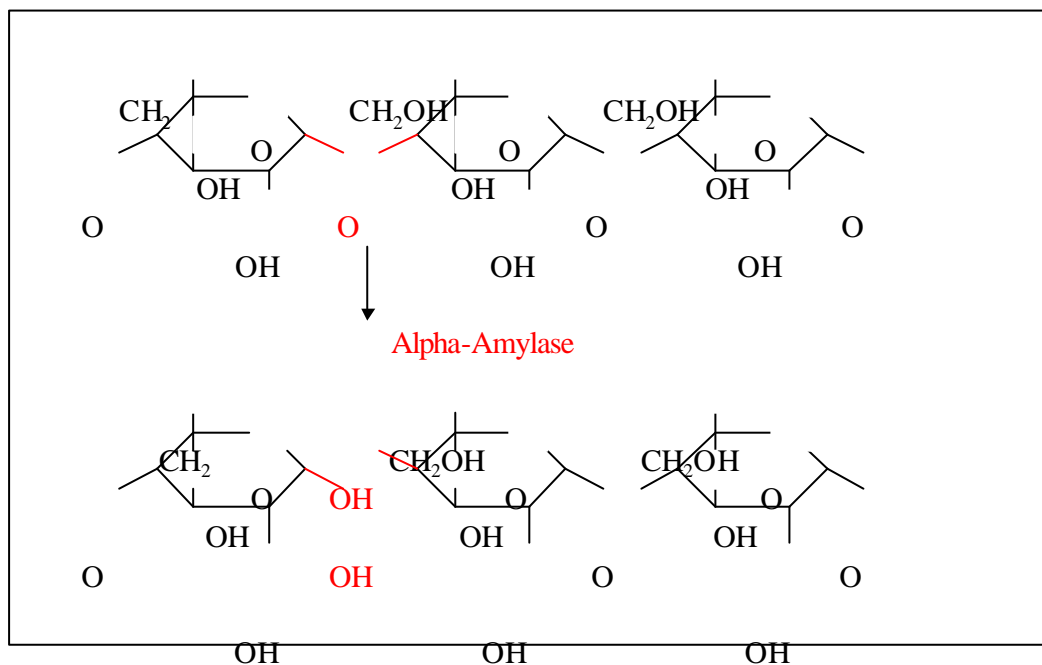
Today, some fabrics are still turned inside out in order to prevent abrasion lines from damaging the material. Better results can be achieved by combining the following prior to adding the denim: alpha-amylase enzyme, a good lubricant and wetting agent, and a higher liquor ratio. The fabric should soak for at least 2 minutes in these chemicals before the pre-wash cycle, in order to prevent irreversible damage to the fibers before the amylase can act on the starch.

### **Typical Chemicals Found on Sized Denim**

| <u>Component</u>            | <u>Purpose</u>                   | <u>% on Fabric</u> |
|-----------------------------|----------------------------------|--------------------|
| Modified corn starch (PVA)  | Stiffness, hand, stability       | 0.0 - 1.0%         |
| Diocylsulfosuccinate (DOSS) | Wetter, rewetter                 | 0.0 - 0.9%         |
| High density polyethylene   | Sanforizing and sewing lubricant | 0.5 - 1.0%         |
| Mineral oil and/or ester    | Sanforizing lubricant            | 0.5%               |
| Silicone                    | Defoamer                         | Trace              |
|                             |                                  | Total: 1.0 - 3.0%  |

## Alpha-Amylase

### Reaction of Alpha-Amylase with Starch



### *Jean Amylase HT*

**Description:** *Jean Amylase HT* is an alpha-amylase produced by a selected strain of *Bacillus subtilis*. Aquazym hydrolyzes starch present in size into soluble dextrin without damaging the textile fibers.

**Application:** It is used for desizing of fabrics and garments at low and medium process temperatures (30-70°C). The high stability and efficacy of the enzyme makes *Jean Amylase HT* compatible with a variety of desizing equipments and procedures.

## Cellulase for Bio-Polishing

### **Bio-Polishing Concept**

Bio-polishing is a biological process in which the cellulase acts on the surface of the yarn. This enzyme is a protein with a specific catalytic action upon the 1,4- $\beta$ -glucosidic bonds of cellulose. The enzyme molecule is more than a thousand times larger than a water molecule and is therefore too large to penetrate the interior of a cotton fiber. Thus only 1,4- $\beta$ -glucosidic bonds which are on or near the surface of the cellulosic fiber are affected. In the reaction, small fibrils protruding from the cotton fiber surface are weakened. They then easily break off from the surface, making it much smoother than before.

The smoothing effect has several benefits: The fiber will have a lesser predisposition towards forming pills and will consequently have a clearer surface structure containing less fuzz. Handling, drapability and water absorbency will also be improved. Furthermore, these changes in the fabric's appearance are long lasting because the Cellulase treatment actually modifies the fiber itself, rather than just coating the surface. Since it is a cellulase, it will function on all cotton substrates such as viscose, flax and ramie, as well as parts of mixed fibers and yarns.

### ***Tri-Cellulase BP-99***

**Description:** *Tri-cellulase BP-99* is a cellulase produced by submerged fermentation of a *Trichoderma* microorganism.

**Application:** *Tri-cellulase BP-99* is used for *Bio-Polishing*. Bio-Polishing is a novel enzymatic process for finishing of cellulosic fabrics in which the enzyme performs a controlled hydrolysis of the cellulosic fibers in order to modify the fabric surface. Bio-Polishing has a lasting effect on knitted as well as woven fabrics, giving improved resistance to pilling, a clearer, lint-free and fuzzless surface structure, and improved drapability and softness.

### **Pigment Dyed Fabric**



Bio-Polished with **Tri-Cellulase BP-99**

## **Bio-Polishing Procedure**

*using*

### ***Tri-Cellulase BP-99***

- Set the bath at 135°F
- Add 0.25 % (owg) ***Tissuwet P-100***
- Circulate for 5 minutes
- Add 1 g/l. ***Jean buffer AC-50 conc.*** (pH 5)
- Circulate for 5 minutes
- Add 2.0 % (owg) ***Tri-Cellulase BP-99***
- Run for 20 - 30 minutes

Drop

Fill and set the temperature to 120°F

Add 0.5 % (owg) ***Soda Ash***

Heat to 180°F

Run for 5 minutes

Drop

Fill / Rinse

Drop

## Cellulase for Jeans Washing

### Cellulase

The second procedure for jeans processing is the abrasion wash. The purpose of this step is to give the jeans the "stone washed" look, which is very popular today.

In this procedure the cellulose from the denim is degraded and transformed into sugar, as illustrated page 48. Since the jeans indigo dye is attached to the cellulose, the dye is also removed. It's this random removal of single dye molecules that makes the jeans appear as though they had been worn naturally.

### Neutral Cellulase Enzymes

#### *Jean Cel NLB-4*

**JEAN CEL NLB-4** is a concentrated liquid engineered component cellulase specifically designed to be formulated into products to be used in premium, high-contrast denim finishing. This storage-stable liquid operates in a low temperature range.

#### ADVANTAGES:

High contrast look. **JEAN CEL NLB-4** enzyme reliably produces a low backstain, high contrast look every time. The contrast between blue and white stays high.

Low operating temperature. The optimal temperature range for **JEAN CEL NLB-4** is 40 – 45°C (104 – 121°F) which is significantly lower than those of other enzymes. Lower operating temperatures can reduce the energy required for processing.

High dose response. **JEAN CEL NLB-4** enzyme has a high dose response which provides flexibility of varying dose, pH, temperature, and time to achieve a wide range of abrasion from light to heavy.

Reduces cycle time. **JEAN CEL NLB-4** enzyme requires less process time than that required by neutral or alkaline cellulases. Less cycle time means more throughput and reduced energy costs.

Reduces stone requirements. Using **JEAN CEL NLB-4** enzyme means that high levels of abrasion can be attained with fewer pumice stones. Using fewer stones reduces fabric damage and machine wear, improves waste treatment, and permits more garments per load.



**PROCESS CONDITIONS:**

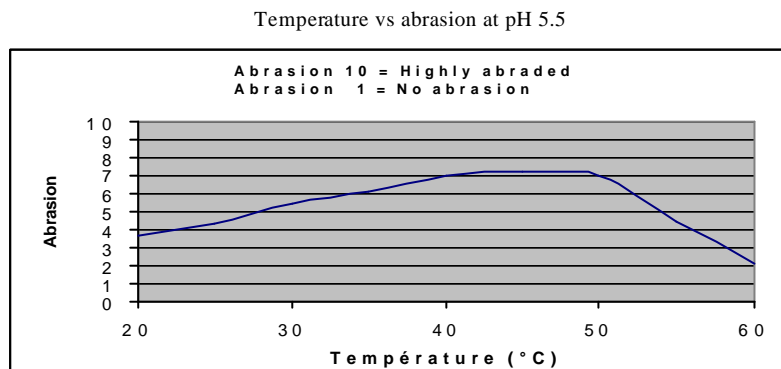
Desizing. Proper and complete desizing is required for consistent performance. Tri-Tex *Jean strip ECO* or *Jean amylase HT* products are recommended for the removal of starch sizing materials.

Auxiliary chemicals. Non-ionic surfactants and/or non-ionic wetting agents can enhance the performance of enzymes and can be used in conjunction with *Jean Cel* or *Jean Cellulase* enzymes. Compatibility should be checked to determine the impact on enzyme performance and stability.

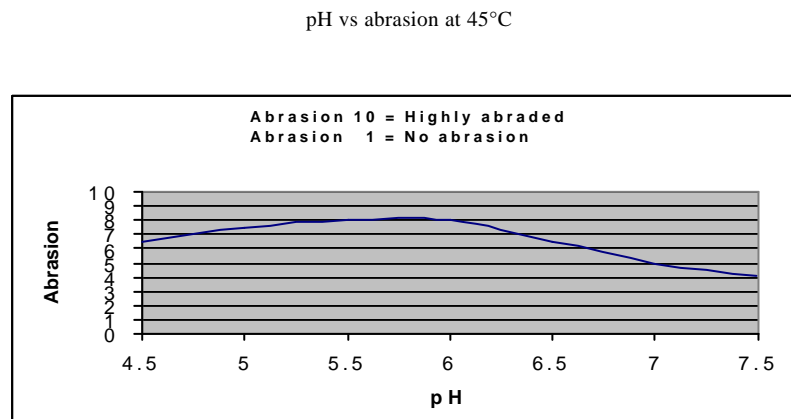
pH and temperature. The combination of pH and temperature has the most effect on wash performance. **JEAN CEL NLB-4** enzyme can be used in a broad pH range of 4.5 – 7.5, within the temperature range of 30 – 50°C. To optimise enzyme performance for abrasion, backstaining and fabric strength retention, use **JEAN CEL NLB-4** enzyme at pH 5.5 or higher and at temperatures below 45°C. If this enzyme is used below pH 5.5, there may be the potential for undesired fabric strength loss.

The recommended dosage range for treatment of denim garments is 0.5% - 3.0% o.w.g.

**Figure 1 :** Relative performance of JEAN CEL NLB-4



**Figure 2 :** Relative performance of JEAN CEL NLB-4



The appropriate dosage of **JEAN CEL NLB-4** enzyme is dependent upon :

- Degree of stonewashed effect desired
- Weight and type of denim being processed
- Cycle time
- Liquor ratio
- pH and temperature of the process
- Type of washing equipment

**Process conditions**

| <b>Process parameter</b> | <b>Optimal range</b>                                      | <b>Operational range</b> |
|--------------------------|---|--------------------------|
| pH                       | 5.5 – 6.5   | 5.0 – 7.0                |
| Temperature              | 40–45°C (104-112°F)                                       | 30 – 50°C (85-121°F)     |
| Liquor ratio             | 5:1 to 10:1   | 3:1 to 15:1              |
| Time                     | Dependent on fabric and process variables<br>15 – 45 min. |                          |

**Application:** *Jean Cel NLB-4*, is designed for use in denim finishing operations when the following is sought: High quality contrast, low degree of indigo back-staining, optimal strength retention, and a high degree of reproducibility and reliability.

**ENZYME INACTIVATION:**

All cellulase enzymes should be inactivated after the desired washed effect is obtained. Insufficient inactivation can result in extended exposure of the garment to active cellulase. This unintended exposure can cause undesirable strength loss of the garment.

**JEAN CEL NLB-4** enzyme can be inactivated by any one of the following procedures :

- A.** Hold the bath at pH > 9.0 and temperature > 140°F for 15 minutes. Soda ash (sodium carbonate) or borax (sodium borate) is recommended for pH adjustment; or
- B.** Treat garments with chlorine bleach; or
- C.** Add sufficient quantity of an alkaline detergent to bring the pH to > 9.0. Hold at > 140°F and pH > 9.0 for 15 minutes.

## **Jeans Washing System**

*With neutral cellulase*

### **Pre-Wash**

**Procedure:** Set the bath at 140°F with a liquor ratio of 5:1  
Add 0.5% *Jean Clear ECO*  
Add 4 % *Jean Strip ATL*  
Run for 20 minutes  
Drop and rinse

### **Neutral Enzymes**

**Procedure:** Set the bath at 115°F liquor ratio of 5:1  
Add 1% of *Jean Clear ECO*  
Add 1g/l. of *Jean Buffer NEU*  
Run for 2 minutes  
Add x% of *Jean Cel NLB-4*  
Run for 30 - 60 minutes (with or without abrasives)  
Drop and rinse  
Add 1 g/l. *Sodium Carbonate*  
Run 10 min at 180°F  
Drop and rinse

**Softener:** Refill at 120°F  
Add 0.5 gr./l. Acetic Acid  
Add 3% *Jeansoft CWS Liq.*  
Run for 10 minutes  
Drop and rinse

## Acid Cellulase Enzymes

### *Jean Cellulase ASF*

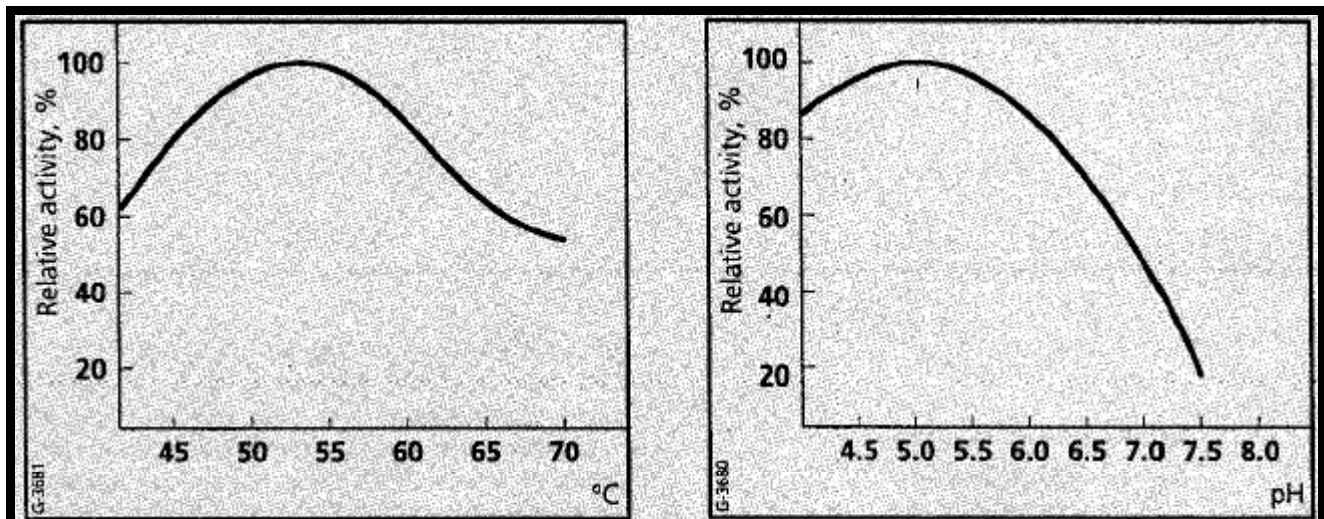
**Description:** JEAN CELLULASE ASF is a liquid cellulase, which has the unique advantage of creating less backstaining than the commonly used cellulase in the finishing of denim. The abrasion will be significant, but with a minimal loss of tensile strength when used according to our recommendations .

**Application:** *Jean Cellulase ASF* is intended for use in stone-washing of denim garments for obtaining abraded looks. *Jean Cellulase ASF* can be used alone or in combination with pumice stones. *Jean Cellulase ASF* has a very good anti-back-staining agent built in.

**Procedure:**

|               |                 |
|---------------|-----------------|
| Temperature:  | 120 - 140°F     |
| pH:           | 4.5 - 5.5       |
| Time:         | 30 - 60 minutes |
| Dosages:      | 0.5 - 1.5% owg  |
| Liquor Ratio: | 6:1 - 10:1      |

*Jean Cellulase ASF* can be used with or without abrasives.



Influence of T° on the activity

Influence of the pH on the activity

*Enzyme treatment could be terminated by thorough rinse with anionic detergent wash off or with 1 gr./l. of sodium carbonate (pH10) at 175°F for 10 minutes.*

## Jeans Washing System

*With acid cellulase*

### Pre-Wash

**Procedure:** Set the bath at 140°F with a liquor ratio of 5:1  
Add 0.5% *Jean Clear ECO*  
Add 4 % *Jean Strip ATL*  
Run for 20 minutes  
Drop and rinse

### Acid Enzymes



**Procedure:** Set the bath at 135°F liquor ratio of 5:1  
Add 1% of *Jean Clear ECO*  
Add 1g/l. of *Jean Buffer AC-50 conc.*  
Run for 2 minutes  
Add x% of *Jean Cellulase ASF*  
Run for 30 - 60 minutes (with or without abrasives)  
Drop and rinse

**\*Light Bleach:** Set the bath at 140°F  
Add X % of *Sodium Hypochlorite (12%)*  
Run for 10 minutes  
Drop and Rinse & Refill  
Add 1 gr./l. *Jean Chlorex PN*  
Run 10 minutes at 130°F, Drop, Rinse  
Refill at 120 F  
Add 0.5 gr./l. Acetic Acid  
Add 3% *Jeansoft CWS Liq.*  
Run for 10 minutes  
Drop and rinse

*\*Light Bleach is to match customer's shade and also clean the back staining.*

### Note: Stopping Enzyme Activity

After the enzyme cycle, it is important to stop the enzymes' activity in order to prevent further color change, as well as tensile strength loss. Enzymes can be chemically neutralized using one of the following three methods for ten minutes:

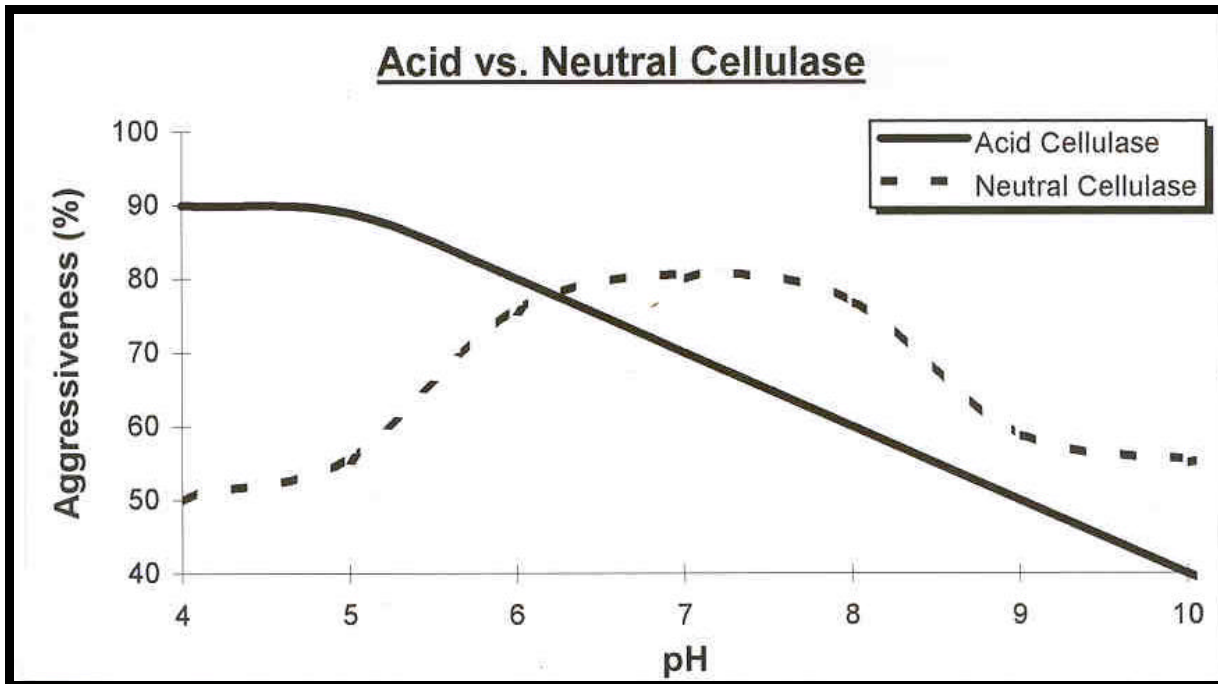
- 1% anionic surfactant at 160°F for 10 minutes.
- Raising the pH to 9 for an acid enzyme, or to 11 for a neutral enzyme, for 10 minutes.



- Raising the temperature to 160°F for an acid enzyme, or to 180°F for a neutral enzyme, for 10 minutes.

## Acid vs. Neutral Enzymes

Acid enzymes are generally produced from the *Trichoderma* bacterium, it's very aggressive and consequently has a higher level of back-staining compared with the neutral enzymes produced from *Humicola*. The differences in staining between neutral and acid enzymes are illustrated below:



**Difference in back staining from Neutral to Acid Cellulases**



**B**ack-staining is usually generated right from the beginning of the jeans washing process. In fact a big amount of indigo dyes is released during the prewash of the Denim Jeans and tend to redeposit on the garment. To prevent this redeposition, we should use an auxiliary in each step of the jeans washing process, and this product is called *Jean Clear CLR*.

## **Jean Clear ECO**

### **Description**

*Jean Clear ECO* is a highly effective anti-back-staining agent used in conjunction with enzymes during jeans washing procedures. *Jean Clear ECO* will help to prevent the released indigo dyes from staining the jeans interior and pocketing during the wash.

### **Physical Characteristics**

**Appearance:** Clear liquid

**Ionic Nature:** Non-ionic

### **Application**

The quantity of *Jean Clear ECO* used will depend on the bath's liquor ratio and the types of enzymes used. At a liquor ratio of 10:1, use 1% *Jean Clear ECO*.

#### **Prewash**

Add 4% *Jean Strip ATL*  
Add 0.5% *Jean Clear ECO*  
Run at 140°F for 20 minutes  
Rinse

#### **Stone Wash**

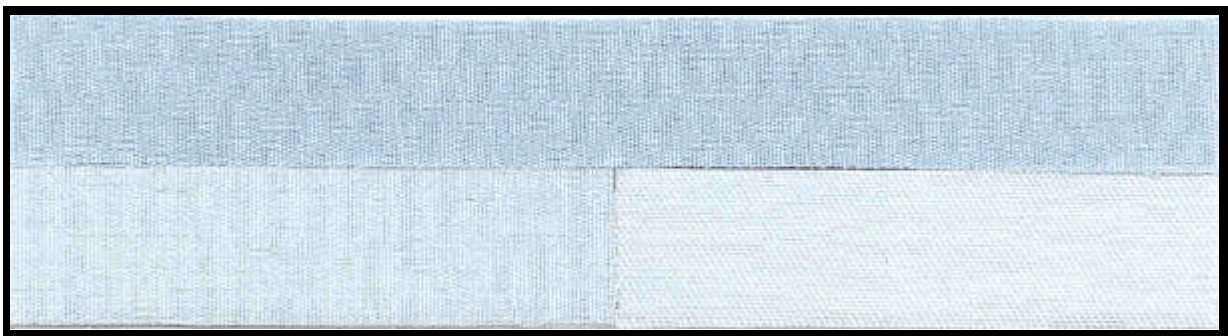
Set pH at 6.5 Run at 130°F for 2 minutes  
Add 1.0% *Jean Clear ECO*  
Add 1.0% - 2.0% *Jean cellulase ASF*  
Run at 135°F for 45 - 90 minutes ( with or without rocks )  
Neutralize with 1 g/L *Sodium Carbonate* 10 min at 160°F if no need for coloration.  
Rinse

Trial In Production  
Machine: 400 lb. Belly Washer (Open Pocket)

L.R.: 10:1  
Quality: 100% Cotton Denim Jeans  
Fabric Load: 24 kg, 30 pieces

## *Jean Clear ECO vs. Competition*

Denim Jeans Pocketing  
Washed Without Anti-Back-staining



**1% Competition**

**1% Jean Clear ECO**

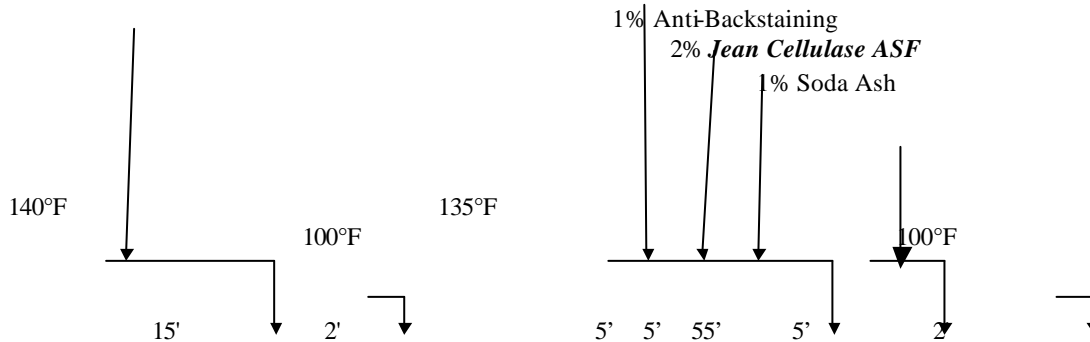
Staining on multifiber with 1% Jean Clear ECO



1 2 3 4 5 6 7 8 9 10 11 12 13

4.0% *Jean Strip ATL*

1% *Jean Buffer AC- 50 conc.*



## NaOCl Bleach

Sodium Hypochloride bleach is used when the indigo's color needs to be lightened for the requirements of fashion, as well as to clean the pocketing and the inside of the jeans (See illustration *Figure 18*). Also used when it's necessary to prepare jeans for the over dyeing procedure with Triazol, Direct, Reactive, Sulphur or Pigment dyes.

**Procedure:** Set the bath at 140°F with a liquor ratio of 10:1  
Add 0.5% owg of Soda Ash  
Add 20 - 30 g/l. of Sodium Hypochlorite 12%  
Run for 10 - 20 minutes (compare to wet standard to prevent over-bleaching)  
Drop and rinse

## Antichloring

This is done because traces of **NaOCl** left on the jeans will form hypochlorous acid, which will consequently yellow and weaken the fabric.

### Antichloring with Jean Permex GC pdr.

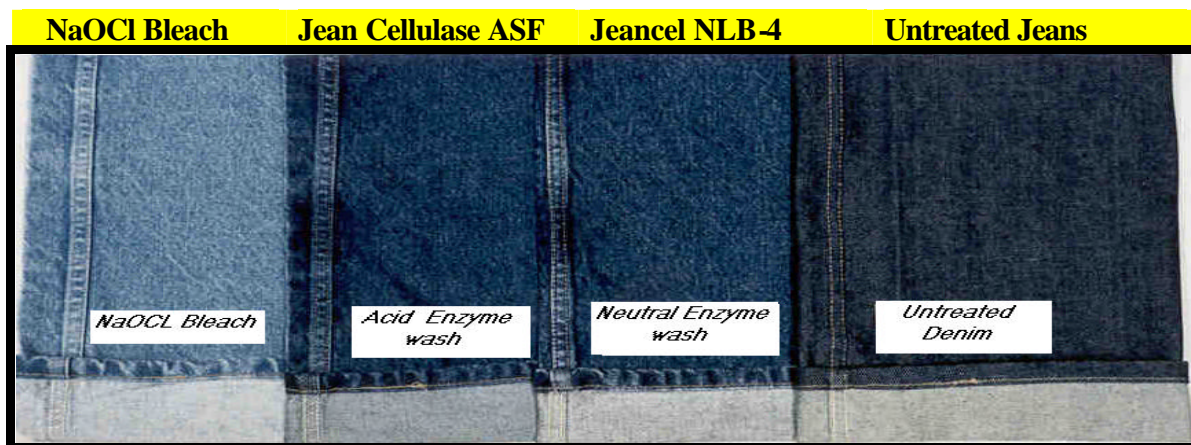
- Economical

**Procedure:** Set the bath at 130°F  
Add 1 g/l. of *Jean Permex GC pdr.*  
Run for 10 minutes  
Drop and rinse twice at 110°F

### Antichloring with Hydrogen Peroxide

- Contributes to oxygen effluent
- Has no significant odor
- Brightens undyed cotton, increasing contrast

**Procedure:** Set the bath at 140°F  
Adjust to pH 9 with Soda Ash  
Add 1 g/l. Hydrogen Peroxide 50%  
Run for 10 minutes  
Drop and rinse





## Bleaching with Potassium Permanganate ( $\text{KMnO}_4$ )

### Procedure:

Adjust water 100°F L/R 20:1

Adjust pH 4.5 with acetic acid

Add 3 - 5 g/l. *Potassium Permanganate* (dissolved)

Run 10 to 20 minutes, depending the shade to match

Drop and rinse twice with cold water

Adjust water level

Heat to 140°F

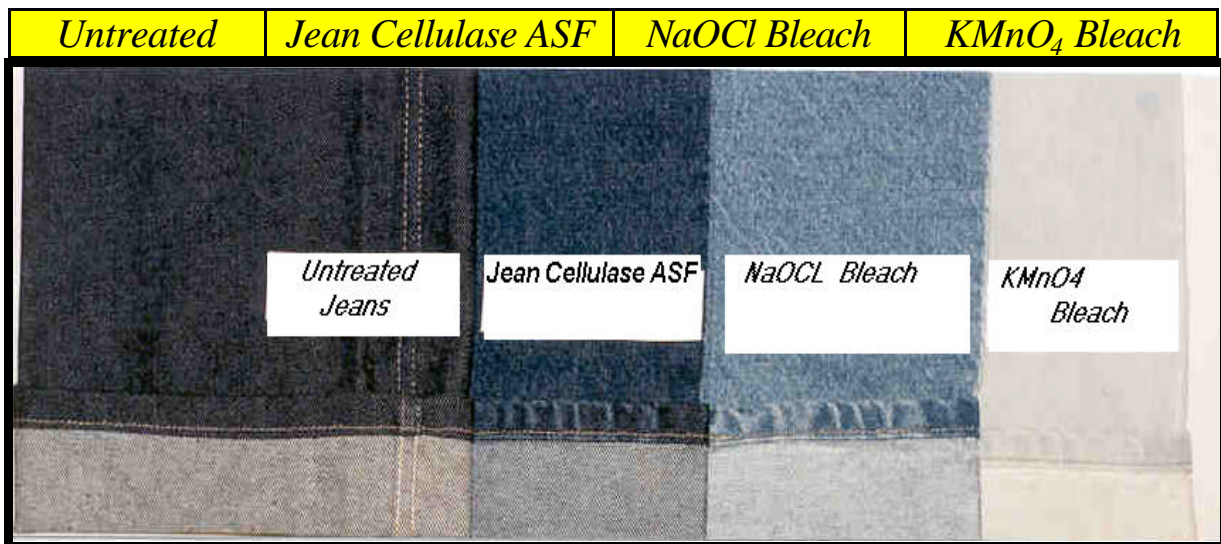
Add 1 g/l. *Jean Permex GC pdr.*

Run for 15 minutes

Drop and rinse twice with cold water

You can use  $\text{KMnO}_4$  when you need to have a whiter garment, in order to subsequently over dye light shades using Direct, Reactive or Triazol Dyes.

## Potassium Permanganate vs. Sodium Hypochlorite





## Trilite II *Decolorizing indigo dyes*

*Trilite II* is an enzyme product called Laccase and specially works to decolorize the indigo dyes in Denim Wet Processing Applications. The *Trilite II* will give a nice grey cast on Denim Jeans, compared to Hypochlorite conventional bleach, at a minimum strength loss, an ideal product for stretch Jeans.

### Advantages

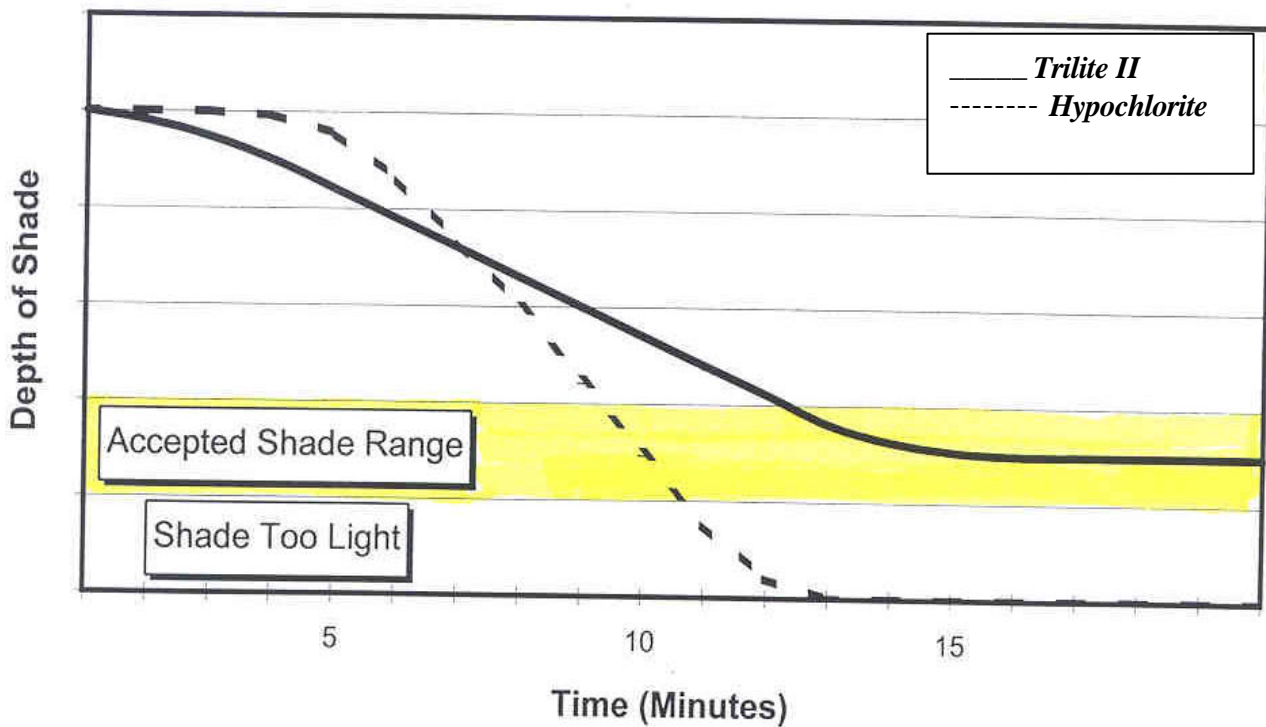
- Improved shade reproduction
- Little effect on fabric strength
- Produces grey shade
- No additional equipment or investment
- Functions at convenient pH and temperature
- Very effective at rendering cellulase inactive

### Disadvantages

- Expensive compared to Hypochlorite
- Doesn't destroy sulfur black dye
- Requires oxygen to function, tightly closed machines, high liquor ratios and low mechanical action can limit activity.

**Procedure:**

|               |                 |
|---------------|-----------------|
| Temperature:  | 130 - 150°F     |
| pH:           | 4.5 - 5.5       |
| Time:         | 12 - 20 minutes |
| Dosage:       | 0.5 - 2.5% owg  |
| Liquor Ratio: | 6:1 - 12:1      |



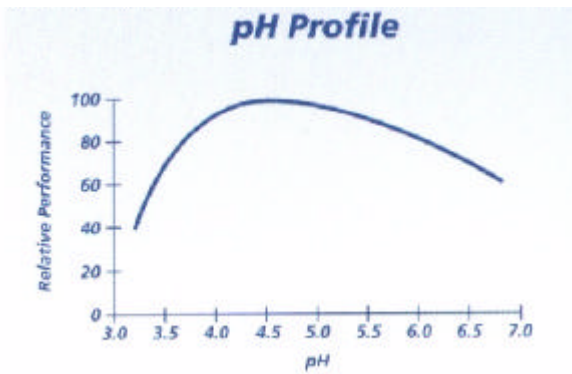
## *New Trilite II Laccase Enzyme*

*Cellulase*      *Trilite II*      *NaOCl bleach*

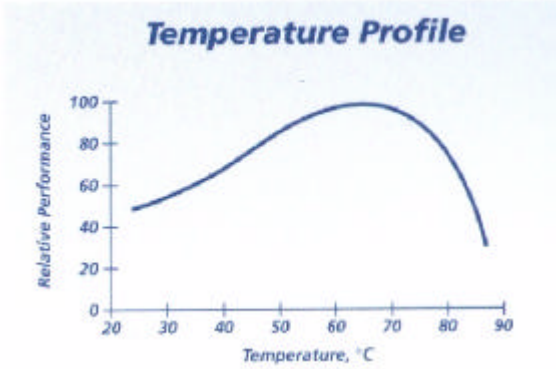


| <i>Application</i>  | <i>When to use Trilite II</i>   | <i>Dose &amp; Time</i>   | <i>Main benefits</i>   |
|---|---|--|--|
| Moderate abrasion enhancement/<br>moderate bleaching effect | After desize & abrasion cycles  | 1.0-2.0% on weight of garment (o.w.o.g.)<br>15-30 min.<br>Single treatment | Reduced processing time.<br>Minimum strength loss.<br>Stone-free abrasion.               |
| Clean-up of redeposition                                    | After desize & abrasion cycles  | 0.2-0.5% o.w.o.g.<br>10-15 min.<br>Single treatment                        | Reduced processing time.<br>Enhanced clean-up relative to conventional scouring agents.  |
| Quick abrasion:<br>reduced abrasion cycle time              | After desize and <u>short-time/low-cellulase</u> dose abrasion cycle  | 1.0-2.0% o.w.o.g.<br>15-30 min.<br>Single or double treatment              | Reduced processing time.<br>Minimum strength loss.<br>Stone-free abrasion.               |
| Combined desize/<br>abrasion                                | After a combined desize/abrasion in same wash   | 1.0-2.0% o.w.o.g.<br>15-30 min.<br>Single or double treatment              | Reduced water consumption.<br>Reduced processing time.                                   |
| Extreme abrasion/<br>high level of bleaching effect         | After desize/<br>abrasion cycles  | 1.0-3.0% o.w.o.g.<br>20-30 min.<br>Multiple treatments                     | Minimum strength loss.<br>Stone-free processing.   |
| Sky blue cast with a high washed-down finish                | Before the hypochlorite bleaching cycle. <u>Note:</u> Hypochlorite and hydrogen peroxide will inactivate DeniLite II. | 1.0-2.0% o.w.o.g.<br>15-30 min.<br>Single or double treatment              | Minimum strength loss.<br>Stone-free processing.<br>Lower hypochlorite dosages required. |
| Grey, flat, low-contrast finish                             | After desize (no abrasion cycle)  | 1.0-2.0% o.w.o.g.<br>15-30 min.<br>Single or double treatment              | Colour-pull without abrasion.<br>Minimum strength loss.<br>Stone-free processing.        |

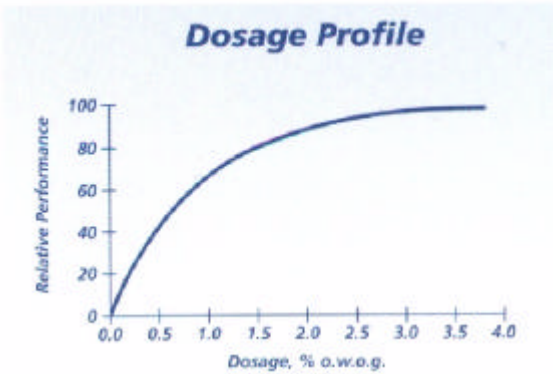
*Performances of Trilite II under different conditions.*



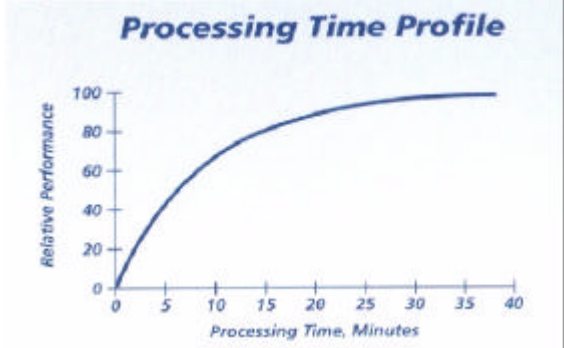
*Use a pH from 4 to 6 to maintain 80% of Efficiency.*



*Use a T° from 60° to 70° to maintain 80% of Efficiency.*



*Use a 1 to 3% owg to maintain optimum Efficiency.*



## **SPECIAL EFFECTS ON D**

*Use 15 to 30 minutes for optimum Efficiency.*

**JEANCOAT FX** is a micro dispersion of an aliphatic polyurethane which offers a high abrasion resistance, which forms a very soft and pliable film and which adheres very strongly to the various substrates.

### **PHYSICAL CHARACTERISTICS :**

|                        |                             |
|------------------------|-----------------------------|
| <b>Appearance</b>      | Semi-translucent dispersion |
| <b>% Non volatiles</b> | 34.0 %                      |
| <b>pH (As is)</b>      | 8.0                         |

### **APPLICATIONS :**

#### **SHINY COAT :**

Spray **JEANCOAT FX** in two thin coats; dry and press with Teflon.

#### **COLORED COATING :**

Mix **JEANCOAT FX** with water and pigments; spray in two thin coats and dry.

#### **SPARKLE COATING :**

Spray **JEANCOAT FX** in two thin coats and sprinkle the sparkle pigments; dry.

### **EQUIPMENT :**



**SPECIAL EFFECTS ON DENIM JEANS**

**DESCRIPTION:**

**AQUA HUE WHITE FL** is a high solids, aqueous, ready to print white. It can be screen or roller printed and is used when excellent fastness properties are required. With adequate application, a gloss effect similar to a “Duco” look can be achieved. The white obtained exhibits good hiding on dyed grounds.

**AQUA HUE WHITE FL** could be diluted with water or mix with **Jean Coat FX** for maximum fastness and then sprayed with HVLP spray gun.

Adhesion quality is very good, even on synthetic substrates such as polyester and nylon. After printing and drying, the fabric is cured for three minutes at 150°C.

Washfastness will vary with different substrates. Therefore, printed fabrics should be checked prior to any production runs to insure that test results will meet the customer’s quality requirements.

**PHYSICAL AND CHEMICAL PROPERTIES:**

|                             |   |
|-----------------------------|---|
| <b>Chemical composition</b> | binder and opacifiers   |
| <b>Appearance</b>           | ready to use, white paste   |
| <b>pH (as is)</b>           | 8 – 10  |
| <b>Stability</b>            | stable under alkaline conditions. Viscosity may drop when exposed to acid conditions. |



Accuspray, David Gevura  
tel: 1-450-242-1004



|              |
|--------------|
| <i>Notes</i> |
|--------------|

|                                |
|--------------------------------|
| <i>Special effect on Jeans</i> |
|--------------------------------|

|                 |
|-----------------|
| <i>Sparkle:</i> |
|-----------------|

|  |
|--|
| <i>Place jeans on a rubber mannequin</i> |
|--|

|   |
|---|
| <i>Spray Jean Coat FX 2 in thin layers with a HVLP spray gun 25 psi</i> |
|---|

|                      |
|----------------------|
| <i>Apply sparkle</i> |
|----------------------|

|  |
|--|
| <i>Press with a layer of Teflon coated with Silicone spray (Jig a Loo)</i> |
|--|

|              |
|--------------|
| <i>Shine</i> |
|--------------|

|  |
|--|
| <i>Spray Jean Coat FX 2 in thin layers with a HVLP spray gun 25 psi.</i> |
|--|

|  |
|--|
| <i>Press with a layer of Teflon coated with Silicone spray (Jig a Loo)</i> |
|--|

|                              |
|------------------------------|
| <i>Shading with pigments</i> |
|------------------------------|

|   |
|---|
| <i>Jean Coat FX 100 ml +water 100 ml +200 ml of Aqua Hue white FL and X%<br/>of pigment as shading component.</i> |
|---|

|  |
|--|
| <i>Shading denim Jeans with Tridirect dyes</i> |
|--|

|   |
|---|
| <i>After the regular enzyme washing</i> |
|---|

|  |
|--|
| <i>add X% of Tridirect F. Brown L2G (well dissolved)</i> |
|--|

|                      |
|----------------------|
| <i>Heat to 190°F</i> |
|----------------------|

|                          |
|--------------------------|
| <i>Run for 5 minutes</i> |
|--------------------------|

|  |
|--|
| <i>Add X% common salt according to chart</i> |
|--|

|                       |
|-----------------------|
| <i>Run 10 minutes</i> |
|-----------------------|

|                         |
|-------------------------|
| <i>Drop, rinse well</i> |
|-------------------------|

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AT YOUR SERVICE.**

The Tri-Tex technical support service is a trouble-shooting team helping streamline production and smooth out start-up problems right where they happen. In mills and factories around the corner, across Canada and throughout the world, Tri-Tex technical teams work in consultation with clients, on-site, to ensure total satisfaction every step of the process.



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to Caracas,  
Montreal to  
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support teams  
are with you  
all the way.*



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anywhere the  
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quality - and  
the quantity  
you want.*





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TO BE THE INDUSTRY LEADER IN OUR FIELD, AS ACKNOWLEDGED BY OUR CUSTOMERS AND SUPPLIERS, IN OFFERING AN UNPARALLELED LEVEL OF TECHNICAL SERVICE AND CUSTOMER SATISFACTION. THE COMMITMENT OF EVERY EMPLOYEE WILL ENSURE OUR CONTINUED GROWTH AND SUCCESS!