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THESIS ON THE “PIONEER” DRIZZLE JET ECO FLOW

- 🌱 **OBJECTIVE:** The aim of this document is to provide the information amongst consumers and governments regarding the **PIONEER™ DRIZZLE JET ECO-FLOW** and highlight the advantages over the traditional Chemical Washing Process.
- 🌱 **BRIEF HISTORY:** As the fashion industry developed in the late 80s–90s, the demand for prewashed/ dyed, vintage garments raised at a rapid scale, so it has seen that numerous brands and garments processing units established businesses, but in the initial days, neither the governments/ consumers nor the manufacturers were aware of the harm, they were doing towards the environment and also they were not too much aware about how much they were wasting the water and chemicals during the washing processes and that leading wasting of money.
- 🌱 **TRADITIONAL CHEMICAL WASHING PROCESS:** The traditional washing process of the garments is as follow:
There are many types of washes. The prominently used are Hard Wash, Half Bleach, Full Bleach, Marble Bleach, Acid Wash, Chemical Wash, Ice Wash, Moon Wash, Bright Wash, Gun Wash, Camel Wash, Ink Wash etc.

- **Different Types of Denim Wash**

After pre-treatment, denim garments may be subjected to different types of wash. Some of commonly used wash types are:

1. Stone Wash
2. Acid Wash
3. Rinse Wash
4. Enzyme Wash
5. Bleach Wash

- 1. Stone Wash**

This is the most common and basic process for producing a washed-down look on denim garments.

Towards the end of the seventies, pumice stones were discovered to accelerate the ageing process of the indigo dyed denim garments.

Wash Components

The stone in widespread use today are pumice stones, which have numerous pores. These pores have sharp edges, facilitating a very high degree of abrasion.

Process

A typical stone wash process is as follows:

The degree of colour fading and change of garment feel depends very much on the ratio of weight of stone to the fabric weight, which can vary from 0.5 : 1 to 3 : 1. During the treatment, the outer most

layer of the indigo-dyed yarn is partially separated and the portion of the fiber inside, which is undyed, comes to the surface. The surface gets a softer handle through the mechanical process with pumice stones.

The degree of the wash-down effect depends upon several factors –

- a. Size of Stone
- b. Stone Ratio
- c. Liquor Ratio
- d. Duration of Treatment
- e. Garment Load etc.

Size

The size of the pumice stones available for stone washing vary from 1 cm to 7 cm in diameter. Pumice stones, around 2 to 3 cm in diameter, are used for finer denim qualities. The common size employed for normal denim qualities is 3 to 6 cm in diameter.

Variants

Different wash names like sand wash, golf ball wash, micro wash and micro-sand wash – which are types of stone wash – refer to the use of very small size pumice stones.

Equipment

Drum washing machines are used for stone washing. The capacity of drum washing machines can be upto 200kgs. Some of these machines are equipped with tilting facility to empty the washed garments.

Stone Wash Effects

- Under the normal circumstance (fabric-stone ratio at 1:2), colour fading is irrespective of the fabric stone ratio.
- Smaller stones give slightly better fading effect, but this would reduce the colour contrast due to more uniform abrasion.
- Fading effect increases with the stone wash time, however, increase of the effect becomes insignificant, when the washing time exceeds 90 minutes.

2. Acid Wash (Moon Wash)

Acid washing or ice washing is usually done by tumbling the garments with pumice stones presoaked in an acid solution, such that localized bleaching is effected in a non-uniform sharp blue/white contrast in the garment.

Wash Components

Pumice stones pre-soaked in sodium hypochlorite (5 to 10%) or potassium permanganate (3 to 6%).

Process

A typical acid wash process is as follows:

The process involves soaking of the pumice stones in a net or mesh fabric in solutions of potassium permanganate for at least one or two hours and then draining off the excess liquor. This treatment results in a very strong bleaching effect at the raised parts whereas the lower parts remains dark. The selection of sodium hypochlorite or potassium permanganate depends upon the dyestuff and the required effect.

Drawbacks

Acid washing or moon washing is a tedious and dirty bleaching process, since the manganese dioxide formed out of potassium permanganate must be removed from the trousers after the process. The hypochlorite bleaching process is fast, efficient and cheap, but it also suffers from a number of disadvantages. The process is relatively difficult to control because it is difficult to obtain the same level of bleaching in repeated runs.

Furthermore, hypochlorite is a harsh chemical that can damage the cellulose, resulting in severe strength loss, breakages and pinholes at the seams and pockets. Since hypochlorite is a hazardous chemical, precaution should be considered while using it in the production floor.

3. Rinse Wash (Mill Wash)

The objective of the rinse washing is to keep the fabric appearance as dark as possible. The denim is desized width-wise in open-width washing machine and the dye is not washed out.

Variants

One variety of the rinse wash is desizing ready to wear trousers in drum washing machines. The disadvantage in this process is very poor rub fastness.

4. Enzyme Wash

As denim is made of cotton, it too consists of cellulose. Celluloses can be used to give denim a worn look. Enzymes have opened up new possibilities in denim finishing by increasing the variety of finishes available. For example, it is now possible to fade denim to a greater degree without running the risk of damaging the garment. Cellulases are the enzymes commonly used in enzyme wash. As the name suggests, it degrades cellulose.

Wash Components

Enzymes are molecular proteins, which accelerate biochemical reactions within a short span of time. The most commonly used enzymes in textile industry include alpha amylases, proteases, catalases and cellulases.

Multi-component enzymes are cellulases introduced by leading manufacturers, which contain a range of different cellulases, which affect different parts of the cellulase.

Mono component enzymes have only one component, and are precise in their action. The denimax range of products belongs to this category.

Advantages of Cellulase (Enzyme Wash) over Pumice (Stone Wash)

The most widely used application of cellulases (neutral and acid cellulases) is the replacement of pumice stones in the 'stone washing' process to produce the aged appearance of denim garments. Some of the advantages of enzyme wash are as follows:

- The use of cellulases instead of pumice stones prevents damage by abrasion to washing machine and the garments, eliminates the need for disposal of the used stones, and improves the quality of waste water.
- The load of garments may also be increased by as much as 50%, since stones are no longer added. Depending on the finishing effect required, a mixture of cellulases and pumice may be used, which causes the surface fibres to weaken and later be removed when subjected to either fabric to fabric abrasion or fabric to stone abrasion during the washing. The temperature and the pH used must be specific to the type of cellulase available.
- While pumice stones are effective on the fibre surface, cellulases react inside the fibre as well.

Process

A typical enzyme wash process is as follows:

Acid Cellulase:

These enzymes are applied at an acid pH value of 4.5 to 5.5 at 50 - 60°C. At the beginning of enzymatic treatments negative effects on the tensile strength could be observed. The application of acid cellulases reinforced the 'backstaining' problem. backstaining is the result of soiling of the weft thread and the pocket lining by the detached indigo dyestuff. The backstaining Problem is effectively dealt with The

Ozone Treatment, known to be ecologically friendly and chemical free Ozone treatment is Opening New Frontiers in Garment washing.

Neutral Cellulase:

Neutral cellulase is used in denim washes. It is applied at pH value of 6 to 7 at 50 to 60°C. Compared to acid cellulases, neutral cellulases have a less negative effect on the tensile strength. For improved surface abrasion, higher quantities are required in the case of neutral cellulase.

An enzyme dose of 2 to 4 grams per litre is normally sufficient. In general, the colour of the enzyme washed goods are more uniform, particularly when stone is not used. Since cellulases are only reactive on cellulose, any sizes or other impurities must be removed before the cellulase treatment.


Neutral cellulase is still more widely used in denim wash than acid cellulase. The reason is that the tendency of indigo dye to redeposit on the surface of the fibre is much higher in acid medium than that in neutral medium.

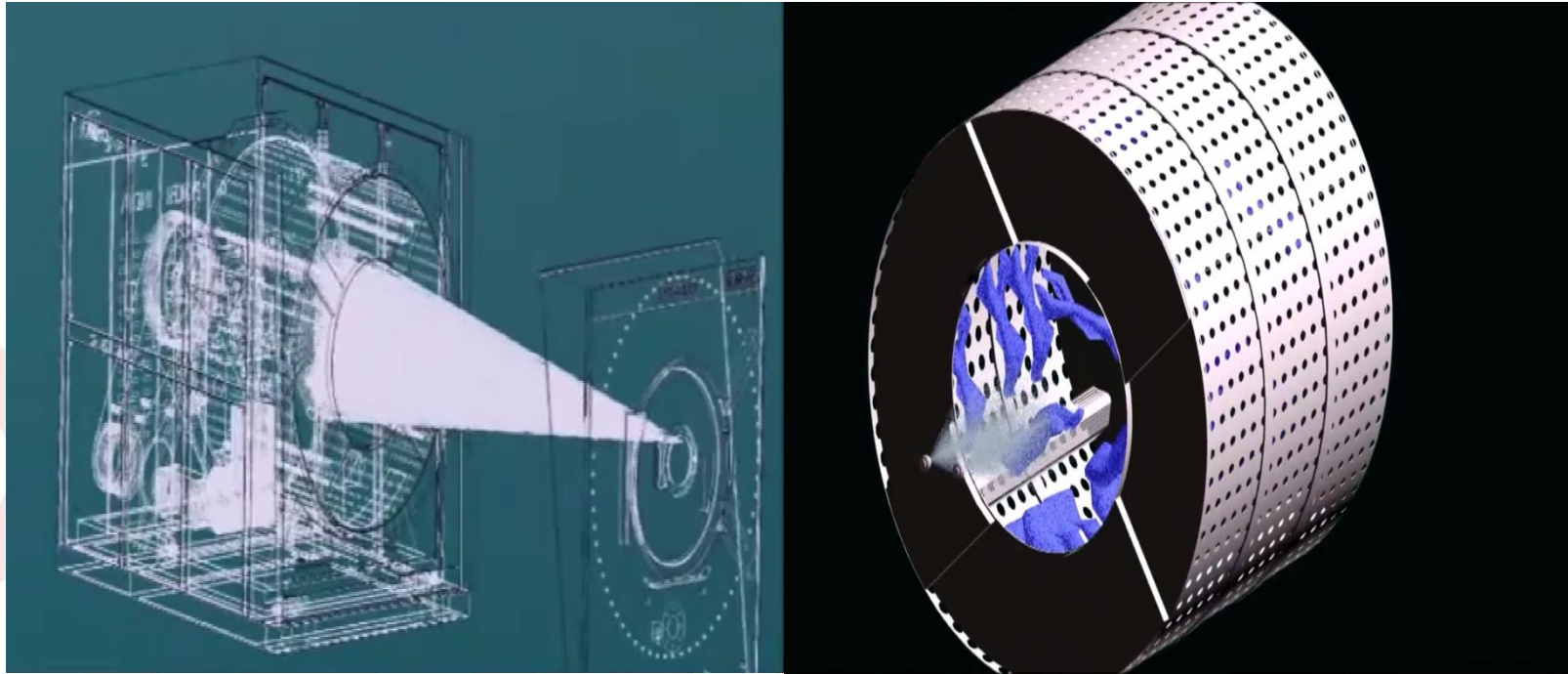
Enzyme Wash Process Parameters

- For neutral enzyme, the best performance is obtained at pH 6 - 7.
- A satisfactory result can be obtained when enzyme dosage is in the range of 0.5 - 2.0 g/l cellulase.

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So, in traditional process of washing requires a huge amount of water. Particularly in enzyme washing process, the chemical mixed in water, but in “PIONEER DRIZZLE JET ECO-FLOW” technology, the use of water inside the washing machine is fully eliminated, instead of it the nanobubbles of air instead of water is sprinkled on garments, that contains chemicals without any dilution. it is explained in detail further in document.

 **PIONEER™ DRIZZLE JET ECO-FLOW:** **PIONEER™ DRIZZLE JET ECO-FLOW** Technology uses micronization and nebulization techniques to eliminate the traditional abrasion processes and delivering better performance chemistry (color, softeners, antimicrobials, etc.) by using nanobubbles of air instead of water. “PIONEER” DRIZZLE JET ECO-FLOW provides great versatility to finishing processes, reducing the cost of application, saving the amount of water used and ensuring that the correct amount of chemicals stays in the garment and not in the water. Basically, the technology and working principle behind the **PIONEER™ DRIZZLE JET ECO-FLOW** is the formation of nanobubbles of air enveloped by concentrated mixture of water and chemicals, and that mist form of water and chemicals are to be sprayed on garments for easy absorption, and **PIONEER™ DRIZZLE JET ECO-FLOW** sprays the mist in a uniform manner throughout the entire drum.



“PIONEER” DRIZZLE JET ECO-FLOW spraying the water and chemical mixture

Leaders In Sustainability

Micronization:

Micronization refers to particle size reduction processes that result in particles size reduction in microns level. So basically, due to this process, **PIONEER™ DRIZZLE JET ECO-FLOW** able to create very small diameter bubbles contain chemical without any notable dilution with negligible amount of water as bubble envelops.



Nebulization:

Nebulization process can be explain as a process of creating a mist out of liquid (water + chemicals), allowing the garments, a quicker and easier absorpction of chemicals in an effective manner.



HOW PIONEER™ DRIZZLE JET ECO-FLOW SAVES CHEMICALS, WATER AND MONEY : PIONEER™ DRIZZLE JET ECO-FLOW saves immense amount of water and chemicals through eliminating the waste of water and chemicals, while the process of washing is to be performed, and provides only necessary amount of chemicals to garments through its state-of-the-art technology.

In a traditional process of enzyme washing, the drum is filled with water, then the chemicals are poured and mixed with water, from this step the waste has been started, firstly the huge amount of water, that will be waste after the washing process and secondly, the chemicals, a large amount of chemical is used in traditional process, is diluted as it mixed with water. Thirdly, the garments are not required that much volume of water and chemical mixture. The garments only absorb a limited amount of mixture ranging from 5 – 15% by volume of mixture. And it varies different type of garments. So basically garments absorb only 5-15% of mixture and remaining amount of mixture of

water and chemicals is wasted and drained out, and **PIONEER™ DRIZZLE JET ECO-FLOW FLOW** reduce the energy consumption to complete the washing process, hence saving of energy too.

PIONEER™ DRIZZLE JET ECO-FLOW saves that water and chemical and energy too, which are going to be wasted during the washing process and drained out after the washing process.

STATISTICS

SILICON WASH

In the traditional process:

Garments:- 65 kgs. (for calculations)

Water required (in litres): 500 - 800 litres

In PIONEER™ DRIZZLE JET ECO-FLOW:

Garments:- 65 kgs.

Water required (in litres): 25 - 30 litres

ENZYME WASH/ BIO POLISH

In the traditional process:

Garments:- 100 Men's Denim Jeans (for calculations)

Water required (in litres): 600 - 1200 litres

In PIONEER™ DRIZZLE JET ECO-FLOW:

Garments:- 100 Men's Denim Jeans

Water required (in litres): 45 - 50 litres

RESIN WASH/ RESIN DIP

In the traditional process:

Garments:- 100 Men's Denim Jeans (for calculations)

Water required (in litres): 500 - 800 litres

In PIONEER™ DRIZZLE JET ECO-FLOW:

Garments:- 100 Men's Denim Jeans

Water required (in litres): 25 - 40 litres






RESULTS

As per the above calculations:

1. **Saving on water:** By using **PIONEER™ DRIZZLE JET ECO-FLOW**, instead of traditional approach, the saving on Water is approx. 50% - 95% depending on the washing process.
2. **Saving on Chemicals:** By only using **PIONEER™ DRIZZLE JET ECO-FLOW**, the total saving on Chemicals, ranging from 80 – 90%.
3. **Saving of Energy:** With **PIONEER™ DRIZZLE JET ECO-FLOW**, saving of Energy is approx. 40%.



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 SAVINGS PER GARMENT	
WATER	50 – 95% 
CHEMICALS	80 – 90% 
ENERGY	40 – 45% 