

Indigo and Sulphar Rope dyeing in Denim: Some Important technical feature.

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Denim is a rugged cotton twill textile in which the weft passes under two (twi – double) or more warp fibers. This produces the familiar diagonal ribbing identifiable on the reverse of the fiber, which distinguishes denim from cotton duck. Denim has been in American usage since the late 18th century. The word comes from the name of sturdy fabric called serge, originally made in Nimes, France, by the Andre family. Originally called serge de Nimes, the name was soon shortened to denim. Denim was traditionally colored blue with indigo dye to make blue “Jeans”, though Jeans then denoted a different lighter cotton textile. Denim is made from a vat dye, Sulphar dye the indigo dye

Rope dyeing is the latest dyeing technology in Denim. Rope dyeing is considered a superior dyeing technology where the dyeing uniformity achieved is better than other. Indigo dyeing technologies like slasher dyeing.

Technical Feature of dyeing of Sulphar Dye:

1 st wash tank	—————>	Causticizing by taking 25 % Caustic soda.
2 nd wash tank	—————>	Hot wash at 70 to 80 °C
3 rd wash tank	—————>	Cold wash at 30 °C

In first & second dye bath take sulphar dye 7 to 9 % on the weight of yarn sheet. Temperature at 95 °C.

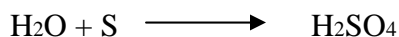
The solution contains the following:

- a) Solubalised sulphar dye = 150 g/l.
- b) Sodium sulphide (reducing agent) is added to increase its reducing power.
- c) Sodium hydroxide = 10 – 12 g/l.
- d) Wetting agent = 3 – 4 g/l.
- e) Antioxidant sulphide (Glucose solution = 4 – 5 g/l) this is added to prevent the oxidation of sulphide solution .it will always remain in reduced form.
- f) In third, fourth and fifth dye bath is cold wash.
- g) In sixth dye bath use H₂O₂ (50%) + Acetic acid (2:1 by weight) H₂O₂ acts as an oxidizing agent. But as it acts on neutral pH = 7 and after cold wash, the solution is slightly alkaline, to make it neutral with add Acetic acid.
- h) In seventh and eighth dye bath = cold wash.
- i) Back wash Box No .4th = Here washing is done with detergent and soda ash at 70 – 80°C.
- j) Back wash Box No. 5th & 6th = Hot wash at 60 – 70°C.
- k) Back wash Box No.7th = Add the softener 30 g/l. It is cationic softener with pH 5 – 6 .As during oxidation of sulphar, strength is reduced by 10 % on the yarn

sulphur are of two types.

- (i) Free sulphur.
- (ii) Reacted sulphur.

The free sulphur will react with moisture in the atmosphere to form.



Which tender the yarn. Now at acidic pH reaction is much faster.

Over all during sulphur dyeing and strong the yarn strength is reduced by 12 – 15 % as compared to Indigo.

Technical Feature of Indigo Rope dyeing In Denim:

The passage of yarns in rope dyeing is as follow.

Pre scouring \longrightarrow hot wash \longrightarrow Cold wash \longrightarrow Dye bath
 \longrightarrow Hot wash \longrightarrow Application of softener (Cationic)

Pre scouring:

- i. The objectives of pre – scouring are the removal of wax content from cotton, removal of trapped air from cotton yarns and making yarn wet.
- ii. This is done at 95°C.
- iii. In pre – scouring use the following ingredients;
Sodium hydroxide: Its quantity depends upon the quantity of cotton fibers used in the mixing. Generally we use 3 – 5 % of sodium hydroxide. It removes the wax by the action of soapification.
Wetting agent: It is anionic in nature.
Sequestering agent: Even with the use of water softening. It is very difficult to find the desired softness in water (about 1 – 3 ppm) .So we use the sequestering agent to make the water soft.
- iv. Why trapped Air should be removed , The reason for this can be understood as follows;
In 1 kg of yarns, there is approx. 2 liters of air. 1 Liter of air decomposes, 2 liters of Sodium hydroxide. It will cause uneven dyeing and more consumption of sodium hydroxide.
- v. Absorbency of yarn may be checked after scouring.

Hot wash:

As some sodium hydroxide is carried by the yarn after pre – scouring, so hot water is given at 80 – 90 °C. If this is not done, this yarn will go into the dye – bath which will change the pH of dye – bath.

Cold wash:

After hot wash, yarn temperature is more .To bring it back to its room temperature cold wash is given to it.

INDIGO DYEING:

1. Indigo is not a perfect vat color. It may be called a trash vat color. The constant of substantivity for other color is 3.0, for indigo it is only 2.7. so there is a need of 5 to 6 dye baths and make the use of multi – dip and multi -nip facility to increase the penetration.
2. The dyeing is done on room temperature as indigo belongs to IK class of vat dyes, where dyeing is done at room temperature and oxidation is done by air only and not by chemicals, if oxidizing agent are used , they will cause stripping of colors.
3. Indigo is not soluble in water, so it is reduced with sodium hydrosulphide. Then caustic soda is added to make sodium salt of vat color to make it soluble. To reduce 1 kg of indigo, 700 gms of sodium hydrosulphide is required.
4. When caustic is added to indigo, it is an exothermic reaction. It is allowed to cool down, then before sending it to feeder, sodium hydrosulphide is added. Reducing agent is not added first as it will be decomposed first, so consumption of it will increase.
5. pH of the dye bath should be kept between 10.5 – 11.5. At this pH, sodium salt of indigo is mono phenolic form. At this form, the strike rate of dye is very high. So after washing, there will be a better dye effect. At pH 11.5 to 11.7, at this affinity is less, the dye effect will be less prominent. pH is controlled by the addition of caustic soda.

Washing :

Wash at 60°C —————> wash at 60°C —————> wash at room temperature
—————> Wash with softener.

Why softener use:

1. The rope is going to be opened at long chain beamer. Its softener is not used, opening will be hampered.
2. It is generally 1.5% of the weight of the yarn. It is a cationic softener. It is always have pH is the range of 4 to 5.5. Softening is done at room temperature. If high temperature is used there is always some chance of tendering of yarn
It belongs to a vat class of dyes. It has a dark blue color with a bronze luster. It belonged to IK class of dyes. In this class, dyeing is done at cold and air oxidation is done to reoxidise the dye. It can be applied on both cellulosic and protein fibers. For protein fibers, a weaker alkaline solution is used. It can be reduced by NaOH and Na₂SO₄ in water to give monophenolate and biphenolate ions as complete solution. Reduced form of Indigo is called Leuco Indigo Leuco has got low affinity for cellulose fiber.

References:

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