

Wrinkle Finish on Denim by Resin Treatment: A Review

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Keywords

Wrinkle Finish, Resin Application, Denim Garments, Curing

Nowadays, fashion in clothing is unimaginable without denim garment with a numerous effect. Various types of dry and wet process are used to make these effect. In this article, 3D/crinkle effect by creating wrinkles on the denim garments preceded by resin application is discussed. This effect gives vintage look as well as add value to the garments though having possibility of decreasing tearing strength.

Introduction

Garment finishing is one of the finishing methods applied on garment, with the use of new technologies and equipment enables to obtain the desired results [1]. For finishing of denim garments, a range of treatment methods such as enzymatic treatment [2-4], bleaching treatment [5-6], acid treatment [7], silicone treatment [8] etc. are used widely. They all are aimed at new possible effects of fabric appearance. Particularly the dry finishing creates many effects on denim fabric, it will stimulate the customers to buy, and also it increases the market potential of the denim market [9]. Resin & its use in denim garments industry to create unique & vintage looks (crinkle effect) which add value to denim garments & improves it salability in market. In 80's, resin being used to give non press, iron free trousers & now it is being used in denims to make wrinkles & creases to look natural vintage which stays after multiple home laundries [10].

Wrinkle and Resins

A wrinkle, also known as a rhytide, is a fold, ridge or crease in the cloth or garments. It is the fabric deformations based on its viscoelastic properties, meaning a slight depression in the smoothness of a surface [11-12, 16]. Wrinkles give fabric a vintage and aged appearance. The wrinkled-jeans look is created with chemicals and machines that manipulate the denim fabric and wrinkle it in the desired areas [13]. Some wrinkle effects on denims are shown in figure 1.



Figure 1. Wrinkle effect on denims.

Resins are viscous liquids that are capable of hardening permanently [14]. Resins mainly fall into two groups, one is deposition type of resins. This type of resins is deposited on the fabric as surface coating. No reaction will take place between the fiber and resin. They include Phenol-formaldehyde resins, Urea formaldehyde resin, Alkyd resins, Ketone resins, Vinyl resins etc. Another is Cross linking type of resins. These types of resins chemically react with the fiber and cross link the fiber molecules [15].

Principle of Wrinkle Formation

Cotton is a cellulosic fiber and its polymer is linked by many hydroxyl (-OH) groups. The structural units of cellulose contain crystalline region, amorphous region and intermediate region. In the crystalline region, the cellulose chains are closely packed and the mobility of the chains is low. However, for the amorphous and the intermediate regions, the molecular chains are temporarily held together with weak hydrogen bonds and the bonding could be broken easily when distortion force is applied. After the force is applied, the temporarily bonds would reform into a new position and the chains are failed to return to their original positions. As a result, wrinkle or crease is formed [16].

How Resin Works

The resin forms covalent bonds to replace the weak hydrogen bonds between the cellulose chains. Therefore, the stability of the bonding would be improved and the molecule chains would more likely to return to its original position. When cellulose cotton fiber is treated with resin agent, intermolecular crosslinks would be strengthening because of the bonding. As a result, cellulose chains would be able to hold the adjacent molecular chains [16].

Resin Application

Resin is applied on finished garment where wrinkle has to be made then wrinkles are created manually or semi automatically [19]. Low formaldehyde or formaldehyde free catalyst integrated crosslinking N, N-dimethylol 4, 5-dihydroxy- ethylene urea (DMDHEU) type resins along with support auxiliaries are being used in a large scale in denim industry [18,21]. Support auxiliaries are used for various purposes such as improving resin penetration into thick fabrics and seams, creating creases at low temperatures, improving handle when used as a softener in last bath, imparting extra shiny look etc. [20]. Different types of resin application systems are described below.

Garment-Dip Method

In the garment-dip method, garments are impregnated with a resin solution, extracted to about 65 percent wet pick-up and then tumble dried to 8-10 percent moisture content [10].

Spray Method

In the spray method is a latest technology of wrinkle finishing, the resin is applied by spraying it onto the garment during tumbling in an enclosed rotational device, or on spray booth where garments being hanged to inflated balloons & sprayed a measured quantity of resin solution [17].

Spray Method with Conveyor

Spray Cabinets with Conveyor allows to apply chemical application to robots dressed up with jeans while, they are moving on the conveyor and is a system that makes easy and increase the workflow and daily capacity [17].

Techniques of Wrinkle Formation

Wrinkles on overall garments or specific desired areas are created manually or automatically by manipulating denim garments in different ways [13]. Some industrial wrinkle making techniques are described below.

By Tying Specific Area with Thread

After resin application, tying is done with thread at the specific area where crinkle effect is desired. The garments is then sent to oven for curing [23].

By Using Clip

In this process the small areas of the garment is bound by using clips on the required areas for desired effect and then garment is put in the oven for curing [18].

By Using 3D Wire Crinkle Machine

This machine consists of 3 operation heads and 3 stations. Variable pressure can produce unlimited crease designs which can be altered easily by changing the wire configuration. The operation time is around 30 seconds.

By Using Garments Crushing Machine

It is a scrunch/ crushing machine of steam system, achieving different levels of wrinkle and/or pressing. This machine is used for scrunch applications and making wrinkle all over the garment. The effects can be adjusted depending on the pressure, steam and chemical level [22].

By Using 3D Bendable Leg

This machine is used to give some crinkle effects on the denim jeans during the washing process. This flexible hanger consists of one station and one flexible hanger. There is no energy consumption in this system. It works just with air [17].

By Using the Crinkle Press

The Crinkle press consists of 2 application stands and one head that will press the trousers to be given effect on these stands. The system works with air and electricity. The air is used for creating pressure force of the air pistons, while electricity is used for feeding resistances of the heating group. The system is sliding and the product can be prepared on one stand while the pressing procedure is carried out on the other [17].

By Using Octopus Crinkle Machines

It has double header 6 head & 6 legs, separate heating in down of each leg and 6 locations can be operated on same time. Two user can operate whole system. All 6 legs and heads can be controlled separately. Front pocket with regions and next fractures can be made at same time and top and bottom heaters blow of one executable request [24].

By Using Knee Effect Machine

This machine is being used for getting loose the knee area of the denim jeans. The temperature and the processing time can be easily adjusted from the control panel [17].

By Using Net Machine

It works with air and pressure of 6 bar and no electricity is required. There is 6 liters air consumption per jeans. The main tube was made from stainless steel. [17].

By Using Double Head Crinkle Machine

Double Head Crinkle Machine is used to obtain permanent crinkle effects on various parts of the garments. Due to its usage ease it is highly preferred. Regardless of the garment size, with the help of double creasing frame of the machine, it is easy to give the crinkle effects on desired parts of garments [17].

By Using Crinkle Machine with Spiral

The Crinkle Machine with Spiral, having 6 heads, is a highly effective wrinkling machine due to its high running speed, fast workflow and as it enables low cost production. The garments to be given crinkle effects before and as well as after the washing process are located on the heaters and treated by the heads of the machine respectively. The crinkling process time is around 30 seconds if the garments are treated before the washing process, whereas it is 20 seconds if the garments are treated after the washing process [17].

Curing with Ovens

Curing is the process to place the fabric at high temperature for allowing the chemical to carry out the reaction process [16]. For high quality 3D crunching / wrinkles, the two most important criteria are temperature and control of cycle [10]. Oven curing is needed to reach right temperature (145–160°C) & time (7–22 min) as per resin tech bulletin advice [12]. Some typical industrial ovens e.g. automatic type ovens with conveyor, box type curing oven with trolley, semi-professional curing ovens with conveyor are being used widely [17].

Parameters in Choosing Denims for Resin Application

The garment finisher usually does not manufacture his own fabric and he may be faced with unacceptable losses in tensile strength, tear strength and abrasion resistance in the fabric when cross-linking [10]. For producing an acceptable 3D effects Denim, several precautions must be taken in fabric selection e.g. the base fabric must have sufficient strength to withstand 40-60 per cent loss in tensile and tear strength and still maintain sufficient strength to provide a garment of acceptable wear life and durability, it must also have excellent absorbency to allow resin to penetrate into the very interior of the fibers and form crosslink's. Surface adhering resins do not serve any useful purpose and are inefficient and wasteful, if the fabric is dyed the dye must be fast to acid catalysis and high temperatures. Sulphur dyes, which are known to generate acid upon storage, are to be strictly avoided & Lycra/Spandex based fabric also should be tested on elongation before mass production. Residual extractable on the fabric (like starch from size) can react with resin and lower its effectiveness, a high degree of size removal is thus essential. Fabric p^H should be between 6.5 to 7. [10].

Advantages and Disadvantages of Wrinkle Finish

Wrinkle effect on denims creates unique & vintage looks that makes the garments more fashionable, hence adding value to denim garments & improves its salability in market. It prevents the intermolecular slippage in the fiber core and it may not harmful if we use formaldehyde free resin.

It decreases the tensile & tear strength, abrasion resistance. It gives an unpleasant odor and unwanted harsh & stiff feel. It may turn the fabric yellow after chlorine bleaching. Sometimes it is difficult to remove unfixed resin [12]. ■

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