

DEVELOPMENT OF DENIM; HOW THE FASHION WORLD LOOKS INTO IT

Maeen Md. Khairul Akter¹, Salim Azad Didar² and Abu Hamja³

¹Envoy Textiles Limited, Mymensingh, Bangladesh

²Southeast University, Dhaka, Bangladesh

³Chittagong University of Engineering & Technology, Bangladesh

^{1,*}maeen_tex@yahoo.com, ²salim_didar16@hotmail.com, ³hamja20@gmail.com

***Abstract-** Denim, a straight-forward cotton woven fabric is, perhaps the most desired fashion product today. Denim is cut & sewn in a diverse variety of attires that are fit for all ages, all seasons and for all occasions. That's what made denim a valuable fashion item and the augmentation in the numbers of customers purchasing it is really evident. Blue jean is probably what one thinks of, when denim is concerned, but the application of denim has actually gone pass the customary trend. And with the evolution of knit structure and comfort in denim, now it is the most preferred category of fabric used in the fashion industry. And no surprise, ten percent of total cotton production of the world is being weaved into denim. This paper tells you about these developments of denim starting from the cotton field to the diversified denim products.*

Keywords: Denim, Jeans, Knit denim, Fabrics.

1. INTRODUCTION

The purpose of this paper is to reveal – the latest developments in denim technology and how it became a darling fashion product. The revolution of denim is really worth of research as the demand of this fabric in the clothing market is sky high. The global market value of denim products are projected to reach a mammoth sixty five billion dollars by 2015. One major characteristic of denim is the amount and variety of off-structure effects that can be designed on it. There are numbers of different denim wash technologies that impart variable color-shades. The most interesting part of denim fabric is probably its irregularity. Where manufacturers toil hard to keep fabrics free of structural and design errors, denim is deliberately made a bit indecent & faddish. In fact a denim jean manufacturer spends more to scratch-out and tear-up a pair of jeans, than what he spends to produce it. The utility of denim is also a big reason behind its success. Though it started with the cow-boys who used it as work-wears, now the knit denims are being used widely even as comfortable leggings for girls. The journey of denim from cow-boy wear to latest fashion wear did take a great deal of development.

2. EVOLUTION OF DENIM

Denim can be considered as the staple garment of the world as all of the people irrespective of their location, age, gender and status own a pair of jeans or two. It's hard to find a wardrobe where there are no denim products in it. Europe, America or Asia, denim is the most common casually used outfit. Now what is this wonderful fabric? Denim as it is defined is a woven fabric with 100% cotton yarn. And when it is sewed into

a pair of trousers it is termed as jeans. In the 1800s unless you were a cowboy or working in the railroad, denim was not meant for you. The fabric actually evolved as the American gold-miners demanded something to wear that can withstand the work-stress and don't tear up easily. A man namely Leob Strauss [1] came up with the solution and started wholesaling it to those who needs it. Afterwards as the invented fabric was working perfect for the workmen, he patented it. He changed his mane to Levi, and the most ancient brand of denim evolved named Levi Strauss. Today, still it is one of the biggest fashion brand of denim jean but the product is not anymore confined to the workmen rather has evolved as a great fashion wear. Now, fashion brands that design and market denim products are endless. Everyday new styles and new designs are born and all of them are accepted warmly in the market.

3. MODERN TREND OF GLOBAL DENIM MARKET

Since the commencement, worldwide market of denim has been evergreen. Centuries ago, denim had a limited usage but with the versatility of its utility now the demand for denim is always sky high in the global market. Irrespective of any market condition, denim get ready acceptance to the consumers.

And no surprise the global market for denim is projected to reach a mammoth sixty five billion dollars by 2015. Though United States were the major denim producer throughout the years but now with the emergence of the Asia pacific countries like, China, India, Pakistan and Bangladesh you can say denim is not any more an American product.

Style and design, the controlling factors of denim market changes every year and offers its customers with new functional blueprints. In 2010, it was skinny fit and low-rise style that dominated the market. In 2011 it was overtaken by flare style and high rise designers' jeans. This year more comfort is incorporated as knit structure is integrated in to denim.

Starting from streets of London to the Bollywood sets in India, on any given day the greater part of the world's population is wearing only one textile - denim. Only Americans purchase around 450 million pairs of jeans every year. The world population wears jeans 3.5 days a week with the highest amount being in Germany at 5.2 days a week. In Germany a typical person owns 8.6 pairs of jeans on average. More than 6 out of 10 people say that they enjoy wearing denim. So by contrast, the number of people who don't like to wear denim is very low. In Russia only 13 percent people are found who don't own a pair of jeans. [2]

Trend of wearing jeans is evident in different parts of the world but there is a clear difference in how much people are willing to spend on a pair of jeans. There not many who are willing to spend more that eighty US dollars for a pair of jeans. Though , America is where denim was born, interestingly most of the Americans are not prepared to pay more than forty US dollars for a pair of jeans. In Russia, around 76 percent of the people are willing to spend only 20 US dollars for a pair of jeans, 26 percent are ready to pay 120 US dollars, 10 percent are ready to pay 200 US dollars and only 5 percent are willing to pay as much as 280 US dollars for a pair of jeans. The designers' signature jeans are even more costly and can cost you up to 500 US dollars. In the UK context, 63 percent people spent less than 47 US dollars for their last pair of jeans, and only 3 percent spent more than 120 US dollars. [3] This is another beauty of denim that it is offered in a broad price range. Consumers who are only willing to pay 20 US dollars have plenty of choices in the market whereas; consumers who can pay even 500 US dollars have their choices in the market too.

3. DEVELOPMENT OF DENIM

The basic style of a pair of denim jeans is much the same today as the first ever pairs from Levi's in the late nineteenth century. Denim is weaved with coarse cotton yarns. The trademark of denim is the indigo dyed warp ends and white weft picks in 3/1 or 2/1 twill weave. The blue face surface and white back surface with prominent twill lines is the identifiers of core denim. But today, denim is not any more confined to only cotton yarns or only indigo blue color. Versatile materials and different colors are integrated into denim now. The most amazing part of denim is definitely the wash effects. This is another beauty of denim jeans is that you want your piece a bit oldish and fade. This is the only textile that is made deliberately abraded. Laser effects, torn out ends, burn effects, sandblasting are common denim effects now. Latest addition in denim techniques is the emergence of knit effects in denim. Denim is now manufactured in knitting machines as well and with this a revolutionary innovation in denim technology is exposed. Some of latest developments in denim technology that are

comparatively new to the world and being highly acceptable in the fashion industry are grouped here.

3.1 Sanforization of Denim

Denim tends to shrink up to 7% after first wash. So a process of pre-shrinking fabric is used called sanforizing that limits shrinkage after wash to less than 1%. It's another beauty of denim that the customers can choose the wash-to-fit or the sanforized jeans that under go very little shrinkage after wash.

3.2 Rope Dying is taking over Slasher Dying

Denim is a yarn dyed fabric, means the yarns are separately dyed before they are weaved into fabric. Rope dying, is now the most popular and color-consistent method, where a group of un-dyed yarns are twisted together and dyed as a single unit, called a rope. The rope runs through a long machine where the yarn is dipped into the indigo and pulled out to oxidize (react with the air). A typical machine allows six to eight dips.

Rope dying is preferred over slasher dying in which individual yarns are separated, laying them parallel to one-another across a cylinder or beam, with each moving through the dye process individually.

Indigo is the basic dye used for denim although denim can have a black, brown, grey, green, red, or yellow cast on it. But for that many processes undergo before the dye meets yarn. Indigo is generally responsible for the blue color, the trademark blue jeans. Indigo is used in various shades to create different blue shades. In many factories sulphur dyes are used with indigo to create a grey or yellow vintage look. To impart fancy colors like yellow or red, pigments are used to dye jeans. But pigments are not readily absorbed by denim, so a resin is used to attach it. Pigments are available in hundreds of colors and with it denim can be dyed in any fancy color as you like. Though basically yarn dyed, jeans can be garment dyed as well. There is no limitation of denim style and the manufacturer can play with it to create new designs. The jeans with same color pocketing and labels are supposed to be garment dyed. Color also can be applied after indigo dyeing to specific areas to create the dirty denim.

3.3 Laundry and Denim Washes

Laundry in denim industry means to create wear patterns in denim. And this is the service that keeps denim apart from any other clothing as the only clothing item that is served abraded. Typically, these natural wear patterns occur on the thigh and crotch (called whiskers), on the ankles (stacks), and on the back of the knees (honeycombs). The most straight forward methods involve either stone or sand to create abrasion. Taking sand paper to the denim, either before or after dying produces a softer fabric. Sandblasting is nothing but the same thing reproduced in an industrial scale where sand is fired on to fabric at high pressure.

Wash technologies are also a big development in denim industry. Wash imparts the desired fade effects that enhance the royalty of denim. Stone washing and enzyme washing are the most popular.

In stone washing a 20 yard fabric roll is put into a 250 pounds washing machine with pumice stones. The fabric and stones are then rotated together. The longer the

rotation the lighter the color of denim produced. Then denim is rinsed, softened and tumble dried. A more efficient and less damaging technique is enzyme washing. Enzyme can eat away the cellulose of cotton and also removes the indigo of dye resulting in a fade effect. Enzymes put lesser trauma on fabric compared to stone wash and produce stronger fabric that lasts long.

For more drastic results combination of both stone and enzyme wash is used. It is called the river washing and it creates a drastic vintage effect. Acid wash is also used for highly contrasted finish with unique patterns. [4]

4. Knit Denim; the latest Technique developed in Denim

The classical denim is a strong durable heavy fabric made from cotton, constructed in a twill weave and woven from coarse indigo dyed or sulphur dyed warp and grey un-dyed weft yarn. Conventional woven denim is not as soft in texture as other knit fabrics and so applications of denim in fashion design that demands elasticity is limited. Since denim takes up a large share of the market in the present world, and knitted fabric has various structures which allows it to fit body shapes and be comfortable, a new way of combining the two methods of fabric construction to create a “Denim effect using knit structures” is developed. Recent survey on children’s denim products showed that comfort, softness and easy care, lightweight and fabric quality of the attributes are considered to be important by both parents and children. Knitted denim fabric with its delicate structure, clear lines, soft, breathable comfort, playing quality thin features is the ultimate solution putting both fashion and comfort in balance.

Shine in this new trend, knitted denim is not only elegant past cowboy rough exterior but becoming popular in an increasingly crowded denim market, anxious to capture new business opportunities. With the varieties of knitted denim continues to expand, knit denim can be used as absorbent, antibacterial and health care purposes, as well as in the T-shirts, children's clothing, sleepwear, underwear, sportswear, casual wear, fashion, etc

4.1 Knit Denim Compared with Woven Denim

Historically, denim has been produced from yarn-dyed spun yarns of cotton or combinations of cotton and synthetic and synthetic blend spun yarns, which have been woven together to provide a fabric having a generally uniform appearance usually provided by a darker basic color throughout in which small flecks of a lighter color are substantially uniformly dispersed, thereby providing a substantially uniformly appearing fabric of colors somewhere between the darker and lighter color. These woven fabrics are typically quite stable, exhibiting little extensibility or stretch to accommodate body movement in garments made from such fabrics.

When such woven fabrics include a substantial amount of cotton or other similar yarns, they are quite susceptible to wrinkling, and therefore do not provide preferred characteristics such as ease of care and a long lasting neat appearance. The present research and

invention provides a denim fabric having good wrinkle resistance and improved extensibility, accommodate body movement and provide comfort in garments made thereof, both of which contribute to the ease of care and long lasting neat appearance of such fabrics. Furthermore, the fabrics of the present research is yarn dyed with reactive dye, as distinguished from the prior art wherein denim fabrics were typically made from indigo dyed yarns, which was rather a difficult and complicated process. After denim fabric knitting, the differentially colorable yarns may be dyed to selectively color one or more of the yarn groups as desired. The denim effect may be enhanced by sanding or napping the denim surface of the fabric to raise the dominant colored yarns and blend the lighter colored yarn therewith. [5]

The knitted denim offers the following advantages in comparison with its woven counterpart:

- The comfort ability of knit denim garments is better than woven denim garments.
- It mold and move easily with body movement.
- Its stretch ability is good.
- It resists wrinkles.
- Most important perhaps is that knits relate well to contemporary life-styles.
- Knit fabrics are usually soft and drape well.
- Thicker fabrics compared to woven fabric which are usually thinner
- Air Permeability is more in knit fabrics

4.2 Production of Woven and Knit Denim

The production of woven and knit denim differs in some extent. Conventional woven denim production needs sequential steps of yarn winding, warping, pretreatment, indigo dyeing, drying, sizing, and finally beaming off. After weaving of the required denim effect fabrics, the desizing process is necessary to take off all sizing materials from the surface of the warp yarn. The inserted weft yarns are grey and in natural color.

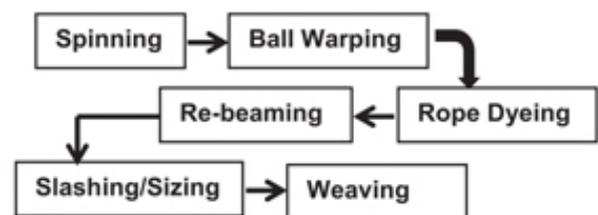


Figure 1: Production flow chart of rope denim

Whereas knit denim production requires much less complicated process and therefore easy to produce. Knit process is direct one step process in manufacturing of fabric from yarn. Therefore, several fragmented processes, which must to follow in woven denim, are not necessary in knit denim process. Only at the conventional Rope Dyeing system a physical re-coning machine will be required instead of Re-beaming machine. [6]

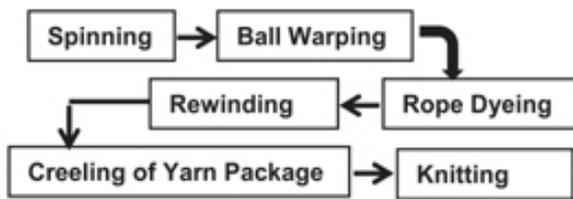


Figure 2: Production flowchart of knit denim

4.3 Methods of Knit Denim Production

The 1st step of the method involves dyeing the yarn with a dyestuff to obtain dyed yarn. Indigo dyeing as well as other dyeing i.e. reactive dyeing and sulphur dyeing can also be used for yarn dyeing of the fabric. The 2nd step involves knitting the foundation layer with grey/white yarn and front layer with dyed yarn to compose denim fabric. Here the front layer is tensely tautened in intermittance with a tensile force greater than the tensile force on the foundation layer to make the foundation layer have random knots. The next step involves washing of denim for creating fading effect if yarn dyeing is carried out using indigo and sulphur dye. Subsequently processes involved in finishing section like drying, compacting etc is carried out to achieve the best quality product.

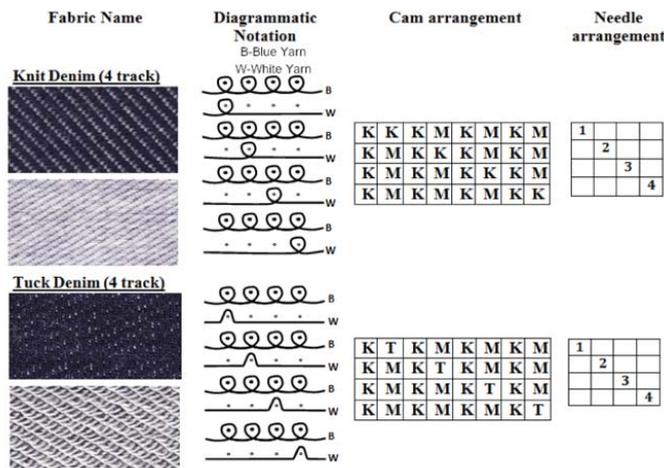


Figure 3: Needle and cam arrangement for Knit denim

Piece dyeing, cheese dyeing and rope dyeing are the conventional methods used for dyeing denim. One of the dyeing methods involved for the present experiment is rope-dyeing method for dyeing knitting yarn to improve fastness and even dispersion of the dyestuff. The rope dyeing is used to drench the knitting yarn into a tank for sopping dyestuff and then the excess dyestuff is removed by passing the knitting yarn through paired rollers as the excess dyestuff gets squeezed out and the

process of drenching and squeezing of yarn is repeated several times until the dyestuff gets properly attached to the knitting yarn. In case of indigo dyeing using rope-dyeing method each strand of yarn is dyed around the surface and thereby leaving the yarn with a white core. The strands of dyed yarn are evenly dispersed and wound onto a bobbin so as to avoid transversal or any discreteness in color during knitting and producing fabric. [7]

5. Conclusion

The jeans, final product from denim fabric are the most popular pant in the clothing arena. But the fashion world is not confined to bottoms and versatile tops are also designed with denim now as you have quite a range of fabrics to choose from. There is no other fabric that provides the fashion designers with so many options to play with. Hundreds of different washes and laundry techniques make hundreds of designs out of the same fabric. As denim is naturally a woven fabric, it sometimes characteristically fails to fulfill specific needs of the conscious and sophisticated customers who are more cognizant about comfort and flexibility. Development of knit denim produced by existing knitting machinery is proving to be a very successful diversification in the denim world. And with both woven and knit structure denim has really advanced to the next level comparing to any other fabric. It's a fabric that has a glorious past and no doubt it has a great future as well.

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