

**A STUDY ON THE DEVELOPMENT OF RECYCLED PRODUCTS  
USING DISPOSABLE DENIM FABRICS**



**DISSERTATION**

*Submitted in Partial Fulfillment of the Requirement for  
The Award of the Degree of*

**MASTER'S PROGRAMME IN FASHION DESIGNING**

**BY  
ROSE ELSA DERRIN  
(Register Number: SM16MFD003)**

**DEPARTMENT OF FASHION DESIGNING  
ST. TERESA'S COLLEGE (AUTONOMOUS)  
ERNAKULUM**

**APRIL 2018**

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External Examiner**

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APRIL 2018**

**CERTIFIED AS A BONAFIDE RESEARCH WORK**

**Signature of the  
Head of the Department**

**Signature of the Guide**

## **CERTIFICATE**

I hereby certify that the dissertation entitled '**A study on the development of recycled products using disposable denim fabrics**' submitted in partial fulfillment of the requirement for the award of the Degree of **Master's Programme in Fashion Designing** is a record of original research work done by Ms. Rose Elsa Derrin during the period of her study under my guidance and supervision.

**Signature of the HOD**

**Signature of Research Guide**  
**Smt. Nair Supriya Damodaran**  
**Head of the Department and Associate Professor,**  
**Department of Fashion Designing,**  
**Women's Study Centre,**  
**St. Teresa's College [Autonomous]**

## DECLARATION

I hereby declare that the matter in this dissertation entitled '**A study on the development of recycled products using disposable denim fabrics**' submitted in partial fulfillment of the requirement for the award of the Degree of **Master's Programme in Fashion Designing** is a record of original research work done by me under the supervision and guidance of **Smt. Nair Supriya Damodaran**, HOD, Department of Fashion Designing, Women's Study Centre, St. Teresa's college [Autonomous], Ernakulam and that the thesis has not previously formed on the basis for the award of any degree work has not been submitted in part or full or any other degree/diploma/associate ship/fellowship or the similar title to any candidate of any other university.

**Place:**

**ROSE ELSA DERRIN**

**Date:**

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I bow my head before **God Almighty** whose grace and blessing enabled me to complete this venture successfully. An opportunity to pay tributes to those who have contributed to the preparation of this thesis is indeed joyful.

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## **ABSTRACT**

Denim is a heavy woven fabric made of strong cotton. It is a cotton warp-faced textile in which the weft passes under two or more warp threads. A diagonal ribbing is produced from this twill weaving which distinguishes it from cotton duck. Denim, one of the most widely used material in the world, has significant impact on environment in manufacturing and waste management stage. Denim recycling has opened vast opportunities for savings in the use of raw materials, energy and water consumption, chemicals and auxiliaries and waste water treatment. In the present study the researcher has recycled denim waste into useful products. The samples selected for the present study were the females of age group between 20yrs to 25 yrs in Ernakulam City as it is found that this age group can make purchasing decisions of their own and also are mature enough to think about environment friendly processes like textile recycling. Based on the survey conducted using a questionnaire five products were selected to be designed and constructed using waste denim. The five products are lampshade, laptop bag, cushion cover, organizer and floor mat. 50 designs were developed for the above mentioned five products (10 designs of each product). The designs were hand drawn and rendered. For each designs, the utility purpose, the aesthetic value and appropriateness was considered while designing the product. Paper patterns of the selected designs were developed by flat pattern making method. The designs were cut on the disposed denim clothing and these were constructed to make the selected products. Feed back was taken on the final products from the target sample. Thus it can be concluded from this study that various utility products can be developed by individuals by themselves using disposable denim and can contribute to the environment protection in a smaller way.

*Key Words :- Denim, Recycling, Utility Products*

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# **INTRODUCTION**

## 1. INTRODUCTION

Denim, the favorite fabric of the youngsters has indeed come a long way. The consumer's choice, although unstable and unpredictable, it has remained almost the same while selecting denim for their fashion item. The scope for denim wear is increasing tremendously every year and its worldwide market share has increased unpredictably in the last few decades. Recently the fashion trend is moving from denim to stretch denim. Stretch denim usually incorporates an elastic component into the fabric to allow a degree of stretch ability in garments.

Denim is a heavy woven fabric made of strong cotton. That is, from 100% cotton coarse indigo dyed warp and grey weft yarn. Denim is a cotton warp-faced textile in which the weft passes under two or more warp threads. A diagonal ribbing is produced from this twill weaving which distinguishes it from cotton duck.

The traditional denim is rather hard and high density fabrics with high mass per unit area. Twill weaves such as three-up-one-down and Two-up-one-down are predominantly used for denim construction. Denim is available in attractive indigo blue shades and is made for a variety of applications and in a wide range of qualities. Denim is durable, comfortable, stretchable, fashionable, affordable and durable for which it is popular in all the age groups (10).

Denims are blue in color because of its indigo dyeing. Here the warp thread is dyed, while the weft thread is left white. As a result of the warp-faced twill weaving, one side of the textile is dominated by the blue warp threads and the other side is dominated by the white weft threads. This causes the wrong side of the blue jeans to be white. Nowadays denims are available in different colors. (19)

## **USES OF DENIM:**

### **Clothing**

Boots and athletic shoes, Capri pants, Dresses, Hats, Jackets, Jeans, Overalls, Shirts, Shorts, including Daisy Dukes and cut-offs, Skirts, Sneakers Suits.

### **Accessories**

Belts, Handbags, Tote bags

### **Furniture**

Bean bag chairs, Lampshades, Upholstery

## **TEXTILE RECYCLING**

Textile recycling is the method of reusing or reprocessing used clothing, fibrous material and clothing scraps from the manufacturing process.

Textile recycling equipment plays an important role in the textile recycling industry - Standard and high-efficiency textile recycling equipment is quite important for supporting the textile industry. The most popular and widely accepted clothing recycling bin, uses a high safety chutes that are easily opened and closed. Some textiles can be remade into other pieces of clothing, while damaged textiles are sorted out to make industrial wiping cloths and other items.

Reduce, recycle, and reuse are the three words to limit waste generation and the human footprint on the environment. It is also called the “waste hierarchy” or “waste management”. It is the order of priority of actions to be taken to reduce the amount of waste generated, and to improve overall waste management processes and programs.



The three R's – reduce, reuse and recycle, help to cut down on the amount of waste we throw away. They conserve natural resources, landfill space and energy.

The concept of reducing what is produced and what is consumed is essential to the waste hierarchy. That is, if there is less waste, then there is less to recycle or reuse. Fashion doesn't have to be expendable; instead by purchasing high-quality pieces less frequently and being creative with the wardrobe we already have can reduce the wastage. Materials like Jeans can be converted to an excellent stuff. A dress can be re-purposed into a skirt, cut into scraps to make patchwork or to give a shirt an artisanal twist.

Learn to reuse items, or re-purpose them for a use, different than what they are intended for. There is also a growing market for sustainable fashion brands that offer affordable and attractive garments made of recycled fabrics. Rather than heading to the landfill, unwanted clothes can be donated to a variety of specialized organizations.

To recycle something means that it will be transformed again into a raw material that can be shaped into a new item. Choosing the products carefully, can be a first step towards efficient recycling. Fibers taken from unmarketable textile waste are converted into low-end materials such as stuffing, automotive components, and low-end blankets. (14)

## **PURPOSE OF STUDY**

Jeans are the ultimate masculine, casual garment, and mostly, men own them and wear them. They have a rich history, but navigating today's world of ripped, faded and embellished jeans to find a pair that suits classic yet modern tastes can be tough.

While denim was exceptionally popular for many articles of clothing on both men and women back in the 1980s and '90s, today the most common apparel found utilizing the cotton warp-faced twill textile is the standard blue jean. One of the most versatile and diversely popular trousers available on the market, it's worn by everyone from Hollywood's leading men to small town farmers in Montana. From designer brands sold for hundreds of dollars in posh department stores to the bargain bin brands sold in supply stores, it's one item of clothing that is popular with just about every demographic.

Sustainability and recycling is the buzz word today, and all stake holders in the apparel supply chain, right from manufacturers to consumers are working toward this cause. This focus has called for research and development all over the world to undertake many issues related to denim recycling to make the best use of used denim materials for new product development. Manufacturing compostable jeans without the use of nylon threads and rivets shows the change in the manufacturing process, and new technologies are in the pipeline to recycle fibers from denim with unchanged quality. The governmental support has also been extended by means of many programs on solid waste management, reduction of load to landfill by reuse and recycling and laws and regulations for environmental protection. This thesis deals with the different denim brands and its impact on society, manufacturing and landfill issues, the methods involved in the reuse and recycling of denim, the review of work done to recycle denim into new products in terms of sustainability.

Denim, one of the most widely used material in the world, has significant impact on environment in manufacturing and waste management stage. Denim recycling has opened vast opportunities for savings in the use of raw materials, energy and water consumption, chemicals and auxiliaries and waste water

treatment. Raising the awareness of the consumer's contribution toward sustainability and environment safety has paved the increase in recycling of not only denim but also many other materials that are used today. The focus should move toward manufacturing products without waste, and if waste occurs, it should be recycled to lead to a zero waste economy. (17)

### **OBJECTIVES OF THE STUDY**

The researcher with the purpose of recycling denim waste into useful products has framed the following objectives:-

- To study about different brands of denim in Ernakulum city
- To collect information about the most moving brand in the existing market
- To conduct survey and understand the product preferences of reused denim
- To design and construct products from waste denim fabrics.
- To collect feedback on the finished products from the targeted group.

**REVIEW OF  
LITERATURE**

## **2. REVIEW OF LITERATURE**

The review of literature pertaining to the present study has been classified under the following heads:

### **2.1 THEORETICAL REVIEW**

- 1) History and origin of denim
- 2) Types of denim
- 3) Characteristics of denim
- 4) Properties of denim
- 5) Different brands of denim (in Ernakulum city)
- 6) Textile Recycling

#### **2.1.1) HISTORY AND ORIGIN OF DENIM**

Although America state to the denim jean trend, the actual fabric is believed to have first been created in the 16th century in Genoa, Italy and Nimes, France, which is where the name 'denim' came from.

The name "denim" derives from the French word *serge de Nîmes*, which means 'serge from Nîmes'.

Denim was initially designed by a Swiss banker named Jean-Gabriel Eynard. In the 1800s, Massena's troops arrived in Genoa and Eynard was given the task of providing them with uniforms. Using his unique indigo cloth, he created trousers called 'Bleu de Genes' which was the first type of blue jean.

The weavers in Nimes attempted to replicate the 'jeans', but instead they created a very similar product. It was coined as 'denim'. The original jean fabric was closer to cotton corduroy. The weavers in Genoa were well known for it. The

coarser and higher quality denim produced in France proved to be more appropriate for the working class people of Italy and France. (19)

In 1851, a young man named Levi Strauss left his home in Germany to join his brothers in New York where they opened a general store. Two years later, Strauss moved to San Francisco in favor of the warmer climate and opened his own dry goods store called Levi Strauss & Co. Its a Wholesale House known for selling fine textiles to local tailors. One of his more prominent customers was a custom-made tailor, Jacob .W. Davis. He is a tailor from Nevada. Jacob .W. Davis manufactured the first pair of rivet-reinforced denim pants. At this time, clothes for Western laborers, such as teamsters, surveyors, and miners, were not very long-lasting. His concept for making strong jeans was inspired when a female customer requested a pair of durable and strong pants for her husband to chop wood. Davis used some copper the rivets to fasten the pockets. Soon, the denim jeans became famous and Davis was overwhelmed with more demand for denim pants. He soon sold out 200 pairs of denim pants to the workers who are in need of heavy work clothing. Davis was struggling to keep up with the demand because of the production capacity in his small shop. He then wrote a proposal to dry goods wholesaler Levi Strauss & Co. that had been supplying him with bolts of denim fabric. Levi Strauss & Co. was so impressed by the possibilities for profit in the manufacture of the garment. They then hired Davis to be in charge of the mass production in San Francisco. Eventually, denim was used and was approved that it served as the best available option for riveted work pants.

It was a hit and the first Levi Jeans were born. Until the 1960s, Levi's called the trousers 'Waist Overalls' rather than jeans. Fitting rather loosely, they were mostly popular with factory workers. In the early 1950s they went from a

practical item to a more fashionable item. Hollywood star, James Dean wore a pair of blue jeans in his hit film *Rebel without a Cause*.

As the '60s flower-power movements began to flourish, the blue jean trousers became popular and were soon socially acceptable to wear in casual dress environments. As their popularity continued to grow, more manufacturers began designing their own versions of blue jeans. Even runway models started wearing them on the catwalks and advertisements came popping up in metropolitan cities like New York, Chicago and Los Angeles where the trousers were marketed not only as work pants, but also as casual wear. They are produced by a vast number of designers and merchants in various shades and washes.(17)

### **2.1.2) TYPES OF DENIM**

It is a symbol of modeling and modern culture. Denim has risen to be a fashion icon and is being adorned by fashion models. Young generation totally depends on denim based garments. In modern days wardrobe is incomplete without denim garments. Additionally, denim is often blended with other fabrics. Denim is very versatile fabric. Blue is the original color of denim but it is also dyed into different colors like black, brown, olive green etc.. Denim is most commonly used as the main raw material in manufacturing of jeans, but it is also used for making shirts, jackets, skirts, dresses, hats, handbags and more.(5)

- **Raw denim or dry denim**

Raw or dry denim is a denim fabric that is not washed after being dyed during its production. Most denim is washed after being crafted into an article of clothing in order to make it softer and avoid shrinkage which could cause an item to not fit after the owner washes it. In addition to being washed, non dry denim is sometimes artificially "distressed" to achieve a worn-in look. Much of

the appeal of dry denim lies in the fact that with time the fabric will fade in a manner similar to factory distressed denim. With dry denim, however, such fading is affected by the body of the person who wears the jeans and the activities of their daily life. This creates what many enthusiasts feel to be a more natural, unique look than pre-distressed denim. To facilitate the natural distressing process, some wearers of dry denim will often abstain from washing their jeans for more than six months though it is not a necessity for fading.

- **Selvage denim**

Selvage denim (also called selvedge denim) is a type of denim which forms a clean natural edge that does not unravel. It is commonly presented in the unwashed or raw state. Typically, the selvage edges will be located along the out seam of the pants, making it visible when cuffs are worn. Although selvage denim is not completely identical with unwashed denim, the presence of selvage typically implies that the denim used is a higher quality. The word "selvage" comes from the phrase "self edge" and denotes denim made on old-style shuttle looms. These looms weave fabric with one continuous cross thread (the weft) that is passed back and forth all the way down the length of the bolt. As the weft loops back into the edge of the denim it creates this "self-edge" or Selvage. Selvage is desirable because the edge can't fray like lower grade denims that have separate wefts which leave an open edge that must be stitched. Shuttle looming is a more time-consuming weaving process that produces denim of a tighter weave resulting in a heavier weight fabric that lasts. Shuttle looms weave a narrower piece of fabric, and thus a longer piece of fabric is required to make a pair of jeans (approximately 3 yards). To maximize yield, traditional jean makers use the fabric all the way to the selvage edge. When the cuff is turned up the two selvage edges, where the denim is sewn together, can be seen. The selvage edge is usually stitched with colored thread: green, white,



brown, yellow, and red (red is the most common). Fabric mills used these colors to differentiate between fabrics.(18)

- **Organic denim**

Organic denim is manufactured from 100% organic cotton. Here no chemicals are used. Instead, potato starch is used.(5)

- **Stretch Denim**

It is usually about 98% cotton and 2% Spandex for a bit of that forgiving stretch. This blend gives you wonderful ease of movement and at the same time some support for those “trouble spots” you aren’t so fond of around the hips or thighs. Stretch denim jeans are one of the fastest growing segments of the women’s market for jeans manufacturers.

- **Poly Denim**

It is the blends that appeal to those who like the look of denim but prefer polyester blends that wash and dry quickly and are lighter weight and a bit dressier. These usually appeal to a slightly older market, but are also finding favor for pantsuits, etc. When the look is meant to be “dressy but casual.”

- **Ramie cotton denim**

Ramie cotton denim is the blends that are found in a variety of combinations, with a wide price variance. Ramie is a plant fiber usually added because it reduces wrinkling and adds a silky luster to the fabric. It isn’t as strong as cotton, however, so it has to be blended with this stronger material in order to stand up as a denim material.(18)

- **Cotton serge denim**

Serge denims are considered as traditional type of denim. It is made of 100% cotton serge. It’s a fabric with diagonal pattern. And they are also known for being sturdy and flexible

- **Colored denim**

They are manufactured with dyed yarn either warp or weft. They are great way to bring out interesting feminine personality when compared to regular jeans. Colored denim is really twill and not denim. Denim specifically refers to the indigo and white fabric that is traditionally used jeans.

- **Bubblegum denim**

Bubblegum denims contain Lycra. It has 35% to 50% stretch. These denims are widely used to make omens items such as shorts.

- **Crushed denim**

Crushed denims are woven with an over twist weft yarn. This denim looks permanently wrinkled and these fabrics shrink when washed.

- **Vintage denim**

These are old looked denims. Normal denim is treated with stone wash or organic enzyme cellulose wash with bleach results in torn and old looking texture over the denim.

- **Ecrú denim**

This denim has not been dyed indigo. These contain single color yarn in its warp and weft.

- **Marble denim**

They are also called acid washed denim. These denims are washed in strong bleach solution.

- **Reverse denim**

In reverse denim right and wrong side are same.

- **Bull denim**

Bull denim is durable and heavy. This denim is perfect for slipcovers, upholstery, draperies, pillow covers, headboards and much more

- **Printed denim**

That has been printed with a pattern- batik, stripe or floral pattern.

- **Slub denim**

These denims are woven using uneven or slub yarn for both the warp and weft threads. It is a rare type of denim. It develops a unique crisscrossed pattern as it fades. It is also called crosshatch denim.(5)

### **2.1.3) CHARACTERISTICS OF DENIM**

- **Cut & Fit**

The cut, or shape, of your jeans is one of the most visible characteristics of your denim. It's also very trendy – think high-waisted bell bottoms in the 70's and baggy wide leg jeans in the 90's. The key to finding a good cut is to balance the style you are comfortable with, the best fit for your frame, and the current trends. For example, if you have a thin frame and like the look of skinny jeans, then a super-slim pair will suit you. In the case of GG editor Sven Raphael Schneider, he has thick thighs and prefers classic, dressy denim. For him, a straight-leg dark wash style is better for his needs.

The waist position of your denim refers to the rise, or where the waistband sits around the midsection. Low rise jeans will sit lower on the abdomen, and so on. Most jeans these days are made with a mid-rise, since high-rise jeans are a 70's trend and low-rise jeans are both harder to find and to wear. A mid-rise jean falls at the natural waistline, and it offers the most flattering fit across a range of body types. As a result, we will focus on mid-rise jeans in this guide.

Aside from color, the cut of the leg is often used to describe jeans in product descriptions, as in “dark wash straight leg jeans”. There are a few main categories of cuts, and when you exclude the wide and flared varieties that are no longer *en vogue*, they include:

**Skinny-** The skinny jeans are pretty self-explanatory; they fit close to the leg from top to bottom and they often feature an ankle-length hem. This style is great for men who want to wear the most now-looking denim or for men with medium to slim legs who like the look.

**Slim Cut-** The slim cut is the slightly looser version of the skinny jean. The width of the leg tapers from the thigh to the ankle. This style is perfect for men who don't want a skin-tight skinny jean, but like the slim and trim look.

**Tapered-** This may remind you of jeans from the 80's, but in fact, the tapered cut can be very flattering for certain body types. It's a little bit looser cut than the slim cut, but it still features a tapered leg that mirrors the modern skinny cut. This style is suited to men with bigger legs or thighs and who like the narrow ankle opening.

**Straight-** This jean features the same width from the top to the bottom of the leg. It is great for men who like a classic look, or don't want to change the cut of their jeans as the trends change. Suited for men with bigger legs but may be too baggy for thinner legs.

**Boot cut-** Boot cut jeans are straight through the thigh and slightly flared at the ankle. Originally they were wide enough to pair with boots, hence the name, but these days' boots are paired with nearly every cut of jean. If you have muscular calves, then this cut might be for you.

The length of denim, much like the cut, is subject to the changing trends. While many men wear their skinny jeans at ankle length or even shorter, we think that like any pair of pants, the traditional approach is length is the best. For example, both overly long and overly short will disrupt the proportions of your pants to the rest of your body, and the result can look odd. Since you can buy denim based on a waist size as well as an inseam, it's typically easier to get a pair of denim to fit off the rack.

- **Color, Wash & Fading**

Denim comes in a amazing array of colors, mostly blue shades, and not all jeans are blue. Even though every color under the sun is now available, if you are interested in a classic look, then you stick with a traditional shade of blue denim. The color of the denim can also be indicated by the wash, or the overall finished look of the colored denim. **Fading** will occur naturally to denim over time, but many companies will offer pre-faded options. Though there are endless ways to fade jeans, there are four main styles of intentional fading:

**Whisker Fade:** These are streaks of fading that usually surround the groin area.

**Train Track Fade:** Located on the outset, these are a fade that promotes the selvage that creates the outer seams by creating two distinct fades that look similar to train tracks.

**Honeycomb Fade:** These are the faded lines that occur naturally behind the knee cap over time. They can be added for a more broken-in look to new denim. These lines get more pronounced as the jeans age and will look better with less washing.

**Stack Fade:** Stacks are created by hemming the inseam a few inches longer than the leg. This causes the jeans to stack up on the shoe and creates a fade throughout the lower leg. This fade isn't recommended because the extra material around the shoe looks sloppy.

Fading is a popular method of altering denim to create new trends, so highly faded denim will quickly go out of style. Any denim that has been faded more than a few shades from the original color will look harsh and is less likely to be wearable for the long term.(17)

#### **2.1.4) PROPERTIES OF DENIM**

To understand the properties, performance and the durability of a denim fabric, it is essential to understand the fibers within the fabric, the yarn, the fabric structure, and what processes and treatments that have been used to produce and finish the fabric.

Fibers contribute to fabric performance and influence product aesthetic, comfort, durability, appearance retention and care. Fiber properties are determined by their physical structure, chemical composition and molecular arrangement. The type of yarn and its structure influence hand and performance. The processes that are used also influence hand, performance, appearance and the performance of the fabric during use and care.

- **PROPERTIES OF COTTON FIBRES**

The fiber length influences the properties of cotton and cotton denim fabric. Longer fibers will give higher durability and quality.

Cotton quality is classified considering staple length, grade and character. Only the two first names play a role when purchasing cotton. In mass production and cotton synthetic blends, low-middling cotton is commonly used. For high quality products, longer staple fibers are preferred. The cotton fibre is a medium strength fibre with a dry breaking tenacity of 3.5 to 4.0 g/d. In contrast with other fibres, cotton will get stronger in wet condition. Strength can increase by 30 %.

The cotton fibre is easily harmed by acids but is not greatly harmed by alkalis. Over all, the abrasion resistance of cotton is good, but heavy fabrics are more resistant to abrasion in comparison with thinner cotton fabrics.

Due to the higher strength in wet condition, cotton can be handled roughly during laundering and in use. No special care needs to be taken when washing and drying cotton and cotton jeans. Dyed cotton products that are washed in too hot

water, may lose colour. For better retention of colour, warm water should be used. Use of chlorine bleach will weaken the fibres and therefore it should not be used on a regular basis.

- **RING SPUN YARNS**

Ring spun yarn is commonly used in denim fabrics. In ring spun yarns the entire fibrous strand is twisted. Ring spun yarns have fibres that are fairly well aligned with the yarn axis. The longer the fibres are, the stronger the yarn will be. Also, yarns with better-aligned fibres are stronger than yarns with less well-aligned fibres. Crease retention is higher for those fabrics containing longer-fibres and better-aligned fibre yarns.

- **DENIM DYES**

Indigo is commonly used to dye blue jeans. There are different types of indigo dye, both natural and synthetic. The synthetic indigo dye is commonly used in the textile industry. Indigo is challenging to dye because it is not soluble in water. To be dissolved, the indigo must undergo a reduction. Generally the indigo has a poor staining to the cotton fibre, which could cause dry- and wet fade and colour loss. When dyeing dark, especially black denim jeans, sulphur dye is used. Like the indigo dye, the sulphur dye is insoluble in water and a reduction has to be made to make it attach to the fibre. Fibres, yarn, fabric and garment can be dyed. For jeans, it is normal to dye the warp before weaving and keep the weft undyed. Sometimes additional dyeing is made on the garment, this is called garment dyeing. Dyes themselves rarely cause damage on the fibres and negatively affect the durability of the jeans. The poor colour fastness to cotton can sometimes be a problem.

- **DENIM FABRIC PROPERTIES**

In denim fabrics the woven structure called 2:1 twill is commonly used. In 2:1 twill warp yarn floats on the surface of the fabric. The twill weave has a technical face and back, the technical face is the side of the fabric with most

pronounced wale. The technical face is usually more durable than the technical back. High count woven fabric, i.e. high amount of interlacing, gives a strong, compact, stable and durable fabric. Low count fabric, i.e. fewer amount interlaces, gives a flexible and soft fabric that easily shrinks. To resist big dimensional changes it is important with a good balance between warp and weft.

- **DIMENSIONAL STABILITY**

Dimensional stability is the ability to resist shrinkage or stretching. As mentioned earlier, fibre content has influence on properties of the fabric.

Three factors that could cause dimensional changes are:

- Tension
- Swelling
- Felting, wool

Tension, and the degree of tension, is one important aspect that influences the dimensional stability. Tensions generally occur during construction when yarns are held stretched. When the fabric later on is exposed to moisture, this can result in dimensional changes. The degree of dimensional change at relaxation depends on weave type, both in warp, weft and on total shrinkage. Extremely compact fabrics or high thread counts are more stable. Woven fabrics usually have a tolerance of  $\pm 3\%$  shrinkage. Studies show that for good dimensional stability, woven fabrics must have a good number of interlacing in both weft and warp direction. It is not enough to have good interlacing numbers in one direction, since woven fabrics must have a stable structure. Also, studies show that fabrics with low crimp values have good dimensional stability because it restricts shrinkage, even at low number of interlacing.

Swelling occurs when fibres are exposed to moisture and the fibre expands. Because of hydrophilic properties, fibres like cotton, flax, silk and rami have great abilities to swell. When fibres swell, their “way to walk” gets longer which will



lead to shrinkage. Due to friction, dimensional changes will retain after drying. Swelling can also result in expansion, so called growth.

To minimize the risk of having large dimensional changes, finishes can be done to prevent this. Depending on type of dimensional change you want to fix, finishing process is chosen.

According to previous studies, a connection could be stated between dimensional change and elastane in denim fabrics. Cotton/elastane blends tended to shrink more, and easier than pure cotton denim fabrics. The tension that is built up in fabric during weaving, will relax after laundering, and cause the fabric to shrink. No conclusion could be made that the amount of elastane in fabrics would have an impact on the dimensional change.

- **TEAR STRENGTH**

The tear strength property of a fabric is its ability to resist a tearing force. Tear strength is an important property for the durability of a pair of jeans. Since the tear strength indicates of the strength of the yarn, this will therefore affect the jeans durability. During the user phase, laundering of jeans will account for a large part of its total wear. Tests made in previous studies have shown that the tear strength of jeans will decrease after laundering, and that loss of durability and tear strength will proceed with number of launderings. While evaluating possible differences between pre washed, stone washed and enzyme washed jeans after launderings, the strength loss was found to be similar for all three. It was also found that in cases where softeners were used during laundering, the decrease of tear strength was larger. The study could also state that if the enzyme wash process is not carefully monitored, the fibre and fabric will get decreased tear strength properties. Studies have examined how the tear strength is affected by laundering and the elastane content of the fabric. There was a tendency of elastane containing fabrics increasing their tear strength after a few washes.(2)

### 2.1.5) **DIFFERENT BRANDS OF DENIM**

In Ernakulum city, there are many different brands of denim are available. Some of the popular brands are Levi's, Lee, Diesel, Wrangler etc..

- **LEVI'S**

The Levi's is the famous clothing company to make denim jeans wear. This is a top jeans brand for both men and women. It was founded in 1853 by the Levi Strauss. It is one of the leading and best known denim brands considered by many youngsters because of the affordable price offered by Levi's.

- **DIESEL**

This company was founded by Renzo Rosso in the year 1987. Diesel is the class producer of the fashion collection. The best in class designers and creative directors makes elegant designs and perfect fit meeting the requirement of the providers. This is yet another popular and most sought jeans brand available in Ernakulum.

- **WRANGLER**

The wrangler is located in the downtown Greensboro. It was first made by the blue bell who acquired Casey Jones in 1940's. They are available worldwide with the best quality in denim jeans. It is hand crafted with excellent designs and tailored with expert tailors. They offer wide range of shades, But mostly known for various shades inn blue denim, contrasting from light to the darker shades.

- **LEE**

The lee is the brand which is dedicated to the innovation, quality, and customer satisfaction in denim brands. They provide best in class jeans with best employees and business associates and welcoming environment of the company. Provides best designs and fit according to the trend.

- **SPYKAR**

The spy park is giving the good quality versatile range of jeans that will best suits for the playful and casual look. They are providing quirky prints to make the dull days to glow up. When worn will surly impress the attraction of the viewers and comes to an affordable price.

- **PEPE JEANS**

They provide with best in quality denim jeans that will ultimately suits the off duty style. When worn it gives a relaxing feel and good fit. They offer wide range of collection through online and offline. They even offers a range of formal and casual cotton wears with best quality.

- **FLYING MACHINE**

The flying machine will be the first Indian company to have in 1980. They provide jeans with authentic details and graphics. They provide best urban outfits with innovative designs and true Italian styling for the Indian company. They offer the youth world with deadly and bold designs that meet the requirements of the wearer.

- **DENIZEN**

The denizen is famous for best quality, style, comfort, promotion and availability for the products. They make premium quality jeans which make remarkable value to make the user look better and feel fantastic. They also promise quality in the craftsmanship and authentic style from the Levi's Strauss and co inhabitant.

- **JACK AND JONES**

Jack and Jones jeans brand are one of the popular brands in jean clothing. They offer 100% pure fabric for their jeans brands. Each and every cloth is made

in china. You can allow those cloths to silicon wash also. These brand jeans are widely worn by teenagers.(8)

### **2.1.6) TEXTILE RECYCLING**

Recycling is the process of converting waste materials into new materials and objects. It is an alternative to "conventional" waste disposal that can save material and help lower greenhouse gas emissions (compared to plastic production, for example). Recycling can prevent the waste of potentially useful materials and reduce the consumption of fresh raw materials, thereby reducing: energy usage, air pollution (from incineration), and water pollution (from land filling).

Recycling is a key component of modern waste reduction and is the third component of the "Reduce, Reuse, and Recycle" waste hierarchy.

Textile recycling is the method of reusing or reprocessing used clothing, fibrous material and clothing scraps from the manufacturing process. Textiles in municipal solid waste are found mainly in discarded clothing, although other sources include furniture, carpets, tires, footwear, and nondurable goods such as sheets and towels.

For consumers, the most common way of recycling textiles is reuse through reselling or donating to charity. The textile recycling industry is one of the oldest and most established recycling industries in the world; yet few people understand the industry, its myriad players, or reclaimed textile products in general throughout the world, used textile and apparel products are salvaged as reclaimed textiles and put to new uses. In general, applications of fibers belong to the following three broad categories: apparel, home furnishing, and industrial. Most of the fiber

products are for short term (e.g. disposables) to medium term (e.g. apparel, carpet, automotive interior) use, lasting up to a few years in their service life.

Textile industry has a long history of being thrifty with its resources; a large proportion of unnecessary waste is still produced each year. Commercially, textile waste generation is influenced by the production of textile goods, higher the production, the greater the amount of waste. This is in turn a function of consumer demand, which is influenced by the state of the economy.

Nowadays, the consumption of synthetic polymers has increased rapidly. This is because these materials have many advantageous properties over other materials including glass, metals, ceramics and woods. For example, they are lightweight, resistant to chemicals and environmental atmosphere. Furthermore, they can be easily processed into desired products by many methods.

- **Types of Textile Waste**

Textile waste can be classified as either pre-consumer or postconsumer waste; Pre-consumer waste consists of by-product materials from the textile fiber, and cotton industries that are re-manufactured for the automotive, aeronautic, home building, furniture, mattress, coarse yarn, home furnishings, paper, apparel and other industries. Postconsumer waste is defined as any type of garment or household article made from manufactured textiles that the owner no longer needs and decides to discard. These articles are discarded either because they are worn out, damaged, outgrown, or have gone out of fashion.

### **Waste Management**

In general, there are four ways of handling the waste. In order of priority,

## **Source Reduction**

To have little or even zero waste Source Reduction is generally the first step that should be considered in an integrated waste management system e.g. avoiding waste generation, internal reuse of waste, reuse in other products etc.

## **Incineration**

It is a process of burning the solid waste to recover the heat energy. Textile waste e.g. short, shredded, loose fibres can also be reincorporated into a palatalized fuel. But, Incinerator chimneys emit organic substances such as dioxins, heavy metals, acidic gases and dust particles, which are all potentially harmful to both humans and the environment. Also, there is a problem disposing of residual ash which is likely to contain a concentration of toxic material.

## **Land Fills**

It should be the last alternative in an integrated waste management system. Textile waste in landfill contributes to the formation of leach-ates it decomposes, which has the potential to contaminate both surface and groundwater sources. Another product of decomposition in landfill is methane gas, which is a major greenhouse gas and a significant contributor to global warming, although it can be utilized if collected. The decomposition of organic fibres and yarn such as wool produces large amounts of ammonia as well as methane. Ammonia is highly toxic in both terrestrial and aquatic environments, and can be toxic in gaseous form. It has the potential to increase nitrogen in drinking water, which can have adverse effect on humans. Cellulose-based synthetics decay at a faster rate than chemical-based synthetics. Synthetic chemical fibres can prolong the adverse effects of both leach-ate and gas production due to the length of time it takes for them to decay.

- **Recycling**

Recycling is a key concept of modern waste management. Recycling is the reprocessing of waste materials into new or reusable products. Ninety-nine percent of used textiles are recyclable. In many applications, especially where metals, glass or polymers (including synthetic textile materials) are involved, the recycling process can only slow down damage to the planet.

The least expensive and least adverse effect on the environment is when a component can be recycled into its original product, i.e. so called 'closed loop' recycling. The second best is when it can be used in another article which usually requires less demanding properties, for example face car seat fabric being recycled into backing material. Typically, recycling technologies are divided into primary; secondary, tertiary. Primary approaches involve recycling a product into its original form; secondary recycling involves melt processing a plastic product into a new product that has a lower level of physical, mechanical and/or chemical properties. Tertiary recycling involves processes such as pyrolysis and hydrolysis, which convert the plastic wastes into basic chemicals or fuels. Recycling can be divided into two types: chemical recycling and physical recycling. The principle of chemical recycling is to convert high molecular weight polymers into low molecular weight substances via chemical reactions. The obtained substances can be used as the reactants for preparations of other chemicals and polymers. In the case of physical recycling, manufacturing wastes and post-consumer products are reprocessed generally into new products using reclamations process or commingled plastics waste processing. Due to its simpler, cheaper and more environmental friendly process, physical recycling is more favorable than chemical recycling.

- **Advantages of Recycling**

- Reducing environmental load through the efficient use of resources, energy and the recycling of used products.
- Recycling include petroleum savings, greenhouse gases reduced, energy conserved.
- Reduces the need for landfill space.
- Reduces pressure on virgin resources.
- Results in less pollution and energy savings, as fibers do not have to be transported.

- **Recycling Technology**

The recycling of resources can be broadly divided into thermal, material and chemical sectors. In the fiber and textile industry, thermal recycling is intended to recover heat energy generated from the incineration of fiber wastes as thermal or electrical energy. Material recycling recovers polymers from fibers or plastics, and at present, the idea of transforming polyethylene terephthalate (PET) into fibers is most economical and widely used for practical purposes. Chemical recycling recovers monomers from waste fibers by polymer decomposition. Impurities can be easily removed from recovered monomers, so their quality will be made exactly equal to virgin monomers.(15)



## **2.2 RESEARCH REVIEW**

Bommel Van Harrie and Goorhuis Maarten (1) conducted a study on ‘Design Jeans for recycling’, a supply chain case study in The Netherlands. This study was conducted to focus on jeans because of the large environmental impacts of cotton and the low recycling rates. This study used an open innovative approach by involving many actors from the different phases of the chain and included student and applied researchers. In a ‘design jeans for recycling’ students’ workshop, prototypes of jeans that are easier to recycle have been developed. Integrating the new generation from different disciplines in the project proved to be very successful. The results show that an open innovation process can lead to very creative ideas and that lessons learned from this project could be used to develop new chain projects for other products. An important condition is that key actors are willing to cooperate in an open innovation approach.

Norris Lucy(13) has conducted research in the UK and India on the global secondhand clothing economy, local systems of reuse in Delhi, and industrial textile recycling in north India. Her study on Trade and Transformations of Secondhand Clothing address, worn clothing markets and recycling technologies from a variety of disciplinary perspectives, charting the expansion of the trade from relative scarcity in the *longue durée* to the current global industry dealing in millions of tons of used clothing. The used clothing economy brings into one frame the links between the market, materiality and morals, revealing complex connections as gifts of clothing are commoditized by charities in the Global North, sold onto the international market, and become a resource for developing local livelihoods in the Global South. The heterogeneity of materials and the temporalities of fashion cycles and disposal strategies create a variable supply of

unknown quality and quantity, for which differential markets must be developed, yet more work needs to be done to understand where the maximum value is extracted, and how this might be measured; issues of reciprocity, power and inequality are implicated at each stage. This study suggests that the specificity of the secondhand clothing economy has much to offer contemporary theoretical concerns with economization, marketization, and the convergence of economic value with cultural values.

Luiken and Bouwhuis (11) conducted a study based on Recovery and recycling of denim waste. It focuses on recovery techniques for both industrial and post consumer denim waste. It further elaborates on recycling techniques for denim waste in the development of high value end products. The importance of design for recycling (D4R) in denim, the options for upcycling denim waste and the possibilities for denim production from other waste materials are also discussed. It even includes environmental aspects and future trends in denim recycling.

Young Carol et.al (20) conducted a study on Sustainable Design of Apparel Using Post-Consumer Recycled Clothing. This study explores sustainable apparel design methods incorporating the use of post-consumer recycled clothing and materials in the design of new products. The name undesigned was assigned to the garment line that was developed for consumers defined as urban nomads. The key concept for this undertaking is described in the term undesigned and was intended to emphasize the quality of the garments as deconstructed and reconstructed or undesigned and redesigned objects with a prior history, as opposed to conventionally designed and produced clothing. Used clothing, available for purchase by the bale through rag dealers, is an abundant source of raw material. The collection designed in 1999 for this study focused on the clothing design needs of urban nomads, a demographic consisting of people living in urban areas who

commute using ecologically sensitive public and human-powered modes of transportation. In this study designs that fill the functional clothing needs of this population were created based on sustainable processes. A general audience's sensitivity to and acceptance of the ecological benefits of a clothing production system defined within sustainability parameters were evaluated in response to these designs.

Shanthi Radhakrishnan(16)conducted a survey on denim recycling. The magic of denim jeans has overpowered the global right from the day it was invented. History has seen its development through many ages and periods. Sustainability and recycling is the buzz word today, and all stake holders in the apparel supply chain right from manufacturers to consumers are working toward this cause. This focus has called for research and development all over the world to undertake many issues related to denim recycling to make the best use of used materials for new product development. Many retailers take immense efforts to showcase their involvement in the closed-loop recycling initiative by encouraging consumers to bring back old used garments for new ones and converting these garments for the manufacture of raw materials or intermediate substances. Manufacturing compostable jeans without the use of nylon threads and rivets shows the change in the manufacturing process, and new technologies are in the pipeline to recycle fibers from denim with unchanged quality. The governmental support has also been extended by means of many programs on solid waste management, reduction of load to landfill by reuse and recycling and laws and regulations for environmental protection. This study deals with the importance of denim and its impact on society, manufacturing and landfill issues, the technologies involved in the reuse and recycling of denim, the appraisal of work done by many organizations around the globe to recycle denim for regenerated

textiles and reclaimed products along with the roadmap for denim recycling in terms of sustainability. Denim, one of the most widely used material in the world, has significant impact on environment in manufacturing and waste management stage. Denim recycling has opened vast opportunities for savings in the use of raw materials, energy and water consumption, chemicals and auxiliaries and waste water treatment. Reprocessed fibers from denim waste have the coloration from the raw material used, and hence, dyeing and finishing processes can be eliminated to a great extent. Many leading retailers like H & M, Adidas and Nike showcase and market their products with the percentage of recycled material in the product profile; their statistical reports reveal the quantity of clothes they have collected from their shoppers and the amount they contribute to international charity from their proceeds. Raising the awareness of the consumer's contribution toward sustainability and environment safety has paved the increase in recycling of not only denim but also many other materials that are used today. The focus should move toward manufacturing products without waste, and if waste occurs, it should be recycled to lead to a zero waste economy.

Chandra Shekar K E,(3) studied on sustainability of processing eternal fashion jeans. The apparel industry's new driving force is high value added products such as denims and Jeans is prompted by increasing competition from the global industry players. Since the demand for the fashionable jeans and other special effects on non-denims is increasing day by day, worldwide chemical consumption in apparel segment especially in Wet processing/ finishing is growing higher and higher. Hence Chemicals play a very significant role by giving a class of touch through the effects, colorful prints to soft handle, from easy care to nanotechnology finish and so on. But, the use of chemicals in finishing has created illicit effects of the environment as a whole. Apparel industries are facing a severe

challenge in the field of quality and productivity, due to the globalization. The highly competitive atmosphere and the more stringent ecological parameters make way for innovations and changes in the present processes. European legislation is looking for RSL free products from 2014 onwards for all the reputed exporters. Hence the challenge for all the exporters are to produce the products concerning the Environment, recycling of materials, usage of less resources, etc... In Production of Jeans, especially in the washing/finishing of jeans lots of chemicals are used, as well as consumption of water and other forms of energy consumption is at the highest level. Hence Jeans manufacturers should think of the waterless treatments, new technology such as Laser technology, combinations of treatments to achieve the desired effect with less consumption of water resources and other energy consumption. Apparel industries must analyze and seriously looking forward to provide one-stop sustainable solution along the whole Textile/Apparel value chain from pretreatment, through dyeing, various Jeans washes to finishing. The understanding of how to minimize the impact of their production on the environment and maximize quality, Innovation and efficient solutions using intelligent chemistry and ecofriendly treatments must be their long term goal. This will promote ecofriendly garments as a whole and counterbalance the harmful effects of the present day chemicals. Hence this article focus on the study of various techniques through which Apparel industries are developing textiles with smart functioning, using new Sustainable products to provide extra comfort and increased performance in an ecofriendly manner. Sustainability will be new mantra or essential for all the denim/jeans brands / Denim manufacturers to withstand in the global environment.

Shanthi Radhakrishnan and V. A. Senthil Kumar (15) conducted a study on Recycled Cotton from Denim Cut Waste. Denim is associated with the history of success and has endured economic challenges and changes in fashion. Due to its

versatility, the connotation it makes as a social statement and acceptance in business meetings and other formal occasions, jeans is considered the top selling 'bottom' in the retail market. The manufacturing of jeans involves cutting and sewing the raw material which may be made of cotton, polyester/cotton blend or cotton with elastane. In apparel production, the marker efficiency ranges from 90 to 95% and a high efficiency leads to low wastage to increase profit margins. Whatever be the marker efficiency fabric wastage results as cut part remains which are usually sold in the market for wiping soils and machines. The world today is moving towards zero wastage and sustainable production with the onus on all members in the supply chain, to take responsibility for their business initiatives and consumption. The policy is to use the waste material as a secondary raw material which may be included in the regular production thereby clearing all grounds of wastage. In an effort to help the industry to move towards zero wastage this study was undertaken to utilize the denim cut waste from the apparel industry and convert them into yarn and fabric in conjunction with virgin material. After many efforts recycled cotton fiber was extracted from the denim cut waste by mechanical means and blended with virgin cotton to produce recycled cotton yarns using different blend ratios. As the fiber was colored the dyeing process was eliminated and fabric was produced using recycled blended yarns as weft and 100% cotton white yarn in the warp to resemble the denim fabric. The fabric was tested for physical, mechanical and comfort tests for recommendation as raw material for apparel manufacture. Thus this method of recycling denim cut waste is sustainable and effective in apparel manufacture.

Karen K. Leonas (9) conducted study on The Use of Recycled Fibers in Fashion and Home Products As the textile, apparel, fashion, and retail industries move to become more sustainable, an area of interest is the use of recycled fiber,

yarn, fabric, and product content in the development and production of new products. The decision to use recycled materials in products must occur during design and product development and continue throughout the manufacturing processes. There are several recognized stages in recycling collection, processing, and then use in a new product. Recycled materials used in textile and apparel products can be obtained throughout the textile and apparel supply chain and post-consumer collection methods. The use of recycled raw materials aligns with the larger movements of global industries toward a circular economy (vs. Linear) and working to achieve a closed-loop production cycle. This chapter reviews the textile and apparel industry, factors that have influenced the generation and use of waste and recycling processes currently used today. Selected brands that have programs and products that contain recycled content are identified here.

Constanza Bianchi (4) conducted a comparative study on consumer's clothing disposal behavior. Fast fashion retailing is leading consumers towards an increased rate of purchasing and the trend to keep clothing for an ever shorter time with the resulting rise in clothing disposal. The aim of this paper is to empirically explore antecedents of two methods of sustainable clothing disposal behavior in two countries: donating to charities and giving away to family and friends. Using data from females located in Australia and Chile, the researchers test the proposed model with structural equation modelling (SEM). The results of this study show that consumer recycling behaviour is a strong and direct driver of donating to charity. In addition, results find that consumer awareness of the environment and consumer age affect donating behaviour. The findings have value for fast fashion retailers, marketers, environmental activists, ecological researchers, charity institutions and public policy makers.

Fatma et.al (6)conducted a study on reusable textiles through An Innovative Waste Management Approach. Rapid increase in volume and types of solid and hazardous waste as a result is becoming a burgeoning problem for environment. It is necessary to ensure effective and sustainable management of waste. Reuse of waste textile and clothing products is a way which avoids throwing the items away and manifest itself in redistributing the items in the form of second-hand clothing via charity shops or textile merchants (also known as rag collectors) and reusing fabrics also introduce as eco-fashion like jean can reused and convert to make various other items like purse, sleeper, coaster & flower etc. with the help of creativity and innovation. Reuse is an innovative and sustainable waste management approach to minimize the solid waste and preserves the "embodied energy" that was originally used to manufacture an item. This review paper creates general awareness about the techniques of waste management copyright of Man-Made Textiles in India is the property of Synthetic & Art Silk Mill's Research Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use. This abstract may be abridged. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material for the full abstract.

Nattha Pensupa et.al (12)together conducted a study on Recent Trends in Sustainable Textile Waste Recycling Methods, and their Current Situation and Future Prospects. The growth of textile markets not only depends on population growth but also depends on economic and fashion cycles. The fast fashion cycle in the textile industry has led to a high level of consumption and waste generation. This can cause a negative environmental impact since the textile and clothing



industry is one of the most polluting industries. Textile manufacturing is a chemical-intensive process and requires a high volume of water throughout its operations. Wastewater and fiber wastes are the major wastes generated during the textile production process. On the other hand, the fiber waste was mainly created from unwanted clothes in the textile supply chain. This fiber waste includes natural fiber, synthetic fiber, and natural/synthetic blends. The natural fiber is mostly comprised of cellulosic material, which can be used as a resource for producing bio-based products. The main challenge for utilization of textile waste is finding the method that is able to recover sugars as monosaccharides. This review provides an overview of valorization of textile waste to value-added products, as well as an overview of different strategies for sugar recovery from cellulosic fiber and their hindrances.

# **METHODOLOGY**

### 3. METHODOLOGY

In order to accomplish the objectives of the present study, the researcher has conducted the following methodology:-

#### ***3.1 SELECTION OF SAMPLE:-***

The samples selected for the present study was the females of age group between 20yrs to 25 yrs in Ernakulam City as it is found that this age group can make purchasing decisions of their own and also are mature enough to think about environment friendly processes like textile recycling. So more precisely the Post Graduate students of St. Teresa's College, Ernakulam were selected as the target sample.

#### ***3.2 SURVEY TO COLLECT INFORMATION ABOUT THE AWARENESS ON THE DIFFERENT BRANDS OF DENIM AND THE RECYCLING METHODS***

A questionnaire was developed to collect information about the awareness on the different brands of denim, the most moving brand and the application of the recycling of denim if any. Also 10 numbers of products were suggested to be made from used denim.

#### ***3.3 DESIGN DEVELOPMENT***

Based on the survey five products were selected to be designed and constructed using waste denim. The five products are lampshade, laptop bag, cushion cover, organizer and floor mat. 50 designs were developed for the above mentioned five products (10 designs of each product). The designs were hand drawn. For each designs, the utility purpose, the aesthetic value and appropriateness was considered while designing the product.

### ***3.4 EVALUATING THE DESIGNS AND SELECTING THE FINAL PRODUCTS***

The first evaluation was done by the 13 teachers of Women's Study Centre, St. Teresa's College, Ernakulam. All designs were ranked according to their preferences. The attributes assigned for evaluation of design were aesthetic appearance of designs, utility of the design and appropriateness of pattern. Points assigned were 1,2,3,4 and 5 indicating unsatisfactory, satisfactory, Good, Very good and Excellent respectively. Five designs from each category were selected based on the highest marks scored. Here Utility of the design was given more weightage and the selection was done accordingly.

The selected designs were rendered according to the fabric that was to be used for construction. A PowerPoint presentation was prepared and was shown to 35 students of the target sample in order to finalize one product in each category.



**PLATE 1 : SURVEY CONDUCTED USING PPT PRESENTATION**

Final five designs were selected in each category according to the marks they obtained based on the aesthetic appearance and utility of the product.

### ***3.5 DEVELOPMENT OF PRODUCTS***

Paper patterns of the selected designs were developed by flat pattern making method. The designs were cut on the disposed denim clothing and these were constructed to make the selected products.



**PLATE 2 : PATTERN MAKING DONE MANUALLY**



**PLATE 3 : PRODUCT STITCHING**

### **3.6 COLLECTING FEEDBACK**

The final developed products were shown to the same 35 students of the target sample and the feedback on the products were noted down in terms of utility, aesthetic appearance and cost effectiveness.

# **RESULTS AND DISCUSSION**

## **4. RESULT AND DISCUSSION**

The results obtained from the study are discussed under the following headings:-

### ***4.1 SURVEY TO COLLECT INFORMATION ABOUT THE AWARENESS ON THE DIFFERENT BRANDS OF DENIM AND THE RECYCLING METHODS***

The questionnaire was distributed to 250 Post Graduate students of St. Teresa's College, Ernakulam.

As per the information availed from the survey it was found that the target group were aware of the denim brands like Levi's, denizen, wrangler, jack and Jones, lee etc... and the most moving denim brands in Ernakulam are Levi's, Lee cooper and Wrangler.

#### ***4.1.1 RECYCLING METHODS***

Most of the students gave away their denim clothing to their younger ones. The total percentages of students who recycle their denims are very low (3 out of 10%) even though they are interested in using denim products.

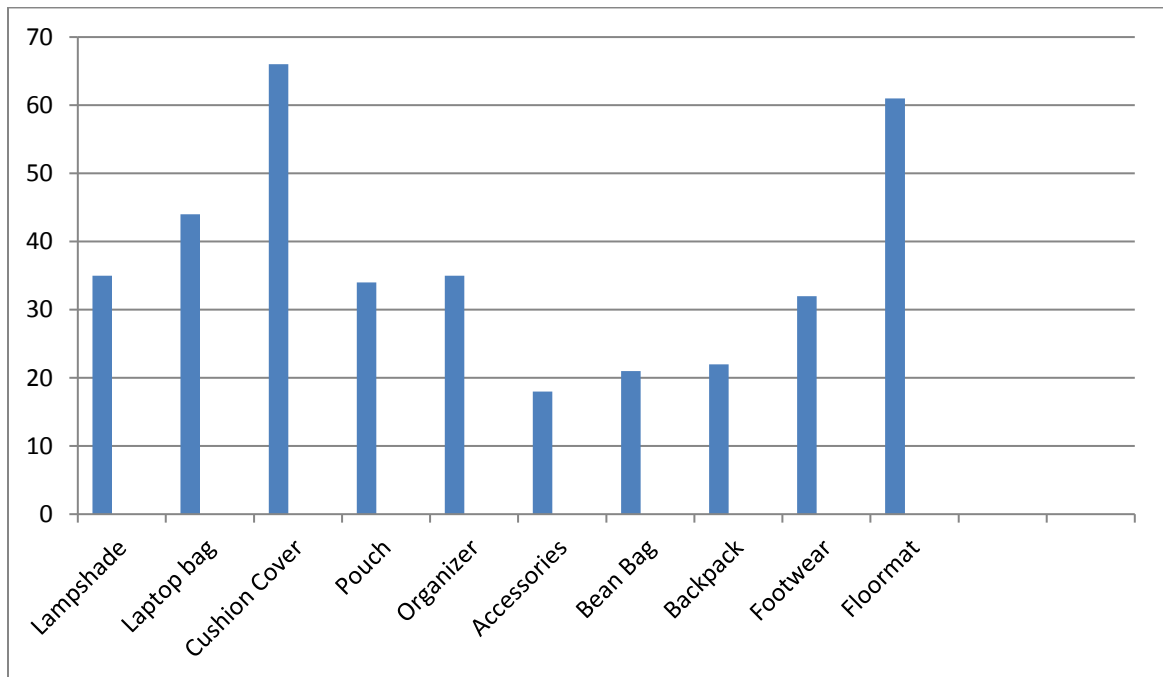
From the 10 products suggested for making, using disposable denim, 5 products were selected as per the preference of the target group. The products suggested were lampshade, laptop bag, cushion cover, pouch, organizer, accessories, bean bag, backpack, footwear and floor mat.



The score obtained by the products are shown in the table 1.

<b>SL NO:</b>	<b>PRODUCT</b>	<b>POINTS</b>
1.	LAMPSHADE	35
2.	LAPTOP BAG	44
3.	CUSHION COVER	66
4.	POUCH	34
5.	ORGANIZER	35
6.	ACCESSORIES	18
7.	BEAN BAG	21
8.	BACKPACK	22
9.	FOOTWEAR	32
10.	FLOORMAT	61

**TABLE 1 – PRODUCT PREFERENCE**



**GRAPH 1 – PRODUCT PREFERENCE**

Product No: 3 (Cushion Cover) obtained the highest score i.e., 66, Product No: 10 (Floor Mat) obtained 61, Product No: 2 (Laptop Bag) obtained 44, Product No: 1(Lampshade) obtained 35 and Product No: 5 (Organizer) obtained 35. Therefore these were products were selected for designing and construction.

## ***4.2 DESIGN DEVELOPMENT***

10 designs were developed for each of 5 products. Totally 50 designs were hand drawn. Design code was given to each design..

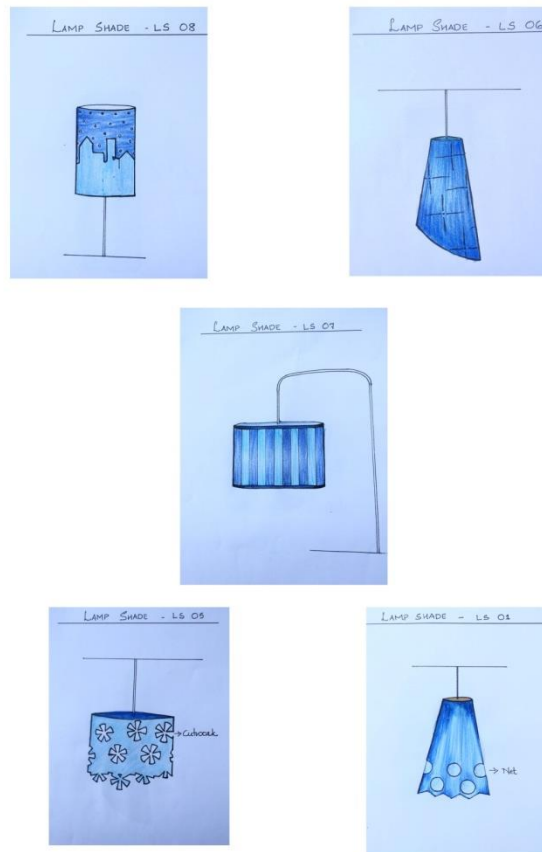


FIGURE 1 : 5 DESIGNS OF LAMPSHADE

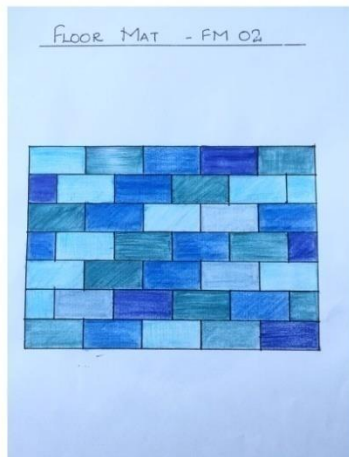
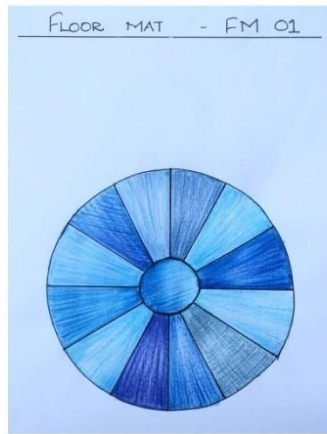
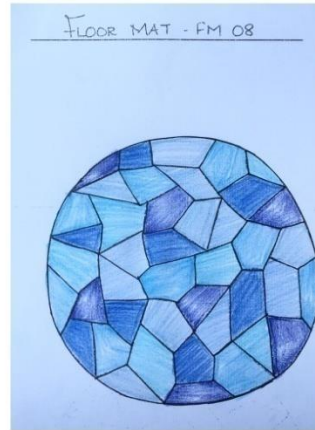
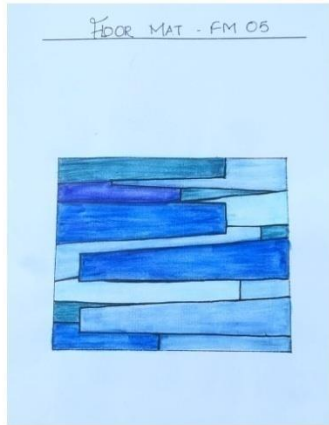


FIGURE 2 : 5 DESIGNS OF FLOOR MAT

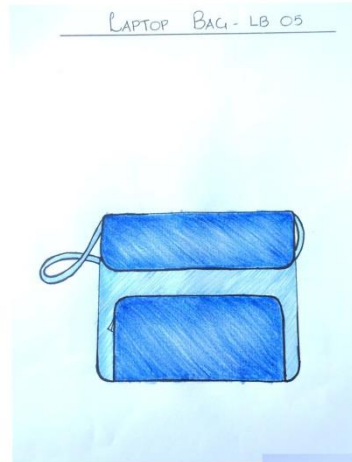


FIGURE 3 : 5 DESIGNS OF LAPTOP BAG

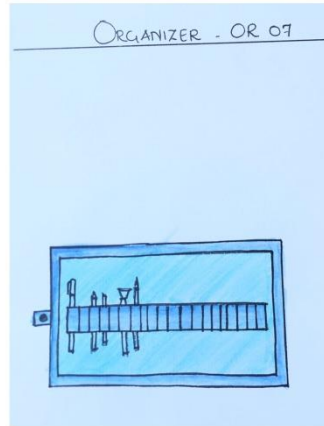
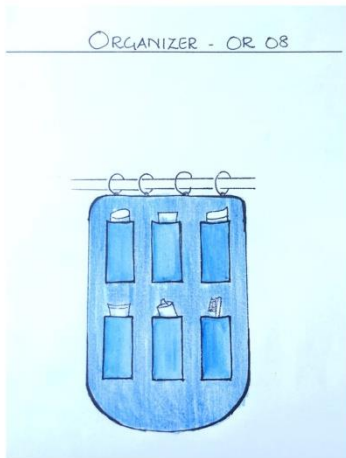


FIGURE 4 : 5 DESIGNS OF ORGANIZER

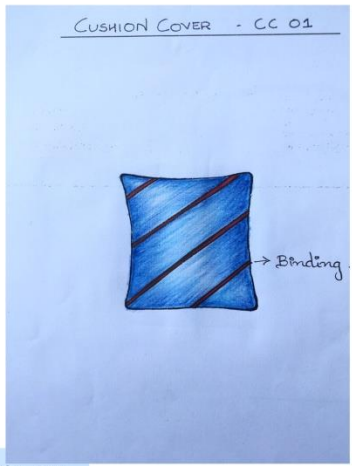
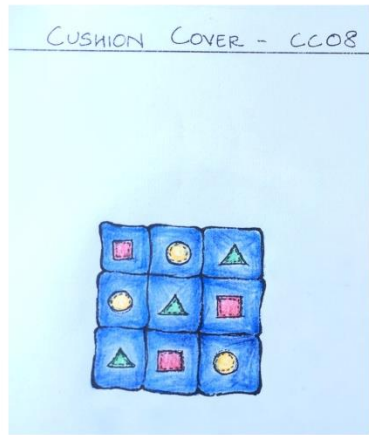


FIGURE 5 : 5 DESIGNS OF CUSHION COVER

### ***4.3 EVALUATING THE DESIGNS AND SELECTING THE FINAL PRODUCTS***

50 designs were evaluated and 5 designs of each product were selected by 13 teachers of Women's Study Centre, St. Teresa's College, Ernakulam on the basis of the utility of the product.

The scores obtained for the selected designs are shown in the table 2.

SL NO	PRODUCT	POINTS (UTILITY)
	<b>Lampshade</b>	
1	LS 05	57
2	LS 08	54
3	LS 01	53
4	LS 06	52
5	LS 07	46
	<b>Floor mat</b>	
6	FM 04	54
7	FM 08	49
8	FM 02	45
9	FM 05	44
10	FM 01	44
	<b>Laptop Bag</b>	
11	LB 05	57
12	LB 04	56
13	LB 07	55
14	LB 06	52
15	LB 01	51

SL NO	PRODUCT	POINTS (UTILITY)
	<b>Organizer</b>	
16	OR 05	59
17	OR 06	55
18	OR 07	52
19	OR 08	50
20	OR 02	48
	<b>Cushion Cover</b>	
21	CC 01	53
22	CC 06	52
23	CC 02	51
24	CC05	48
25	CC 08	46

TABLE 2- DESIGN EVALUATION

These 25 designs were designed and rendered according to the colour of the fabric going to be used and these were again evaluated by the 35 Post Graduate students. Final 5 designs were selected on the basis of its utility and aesthetic appearance ( 1 design from each product category).

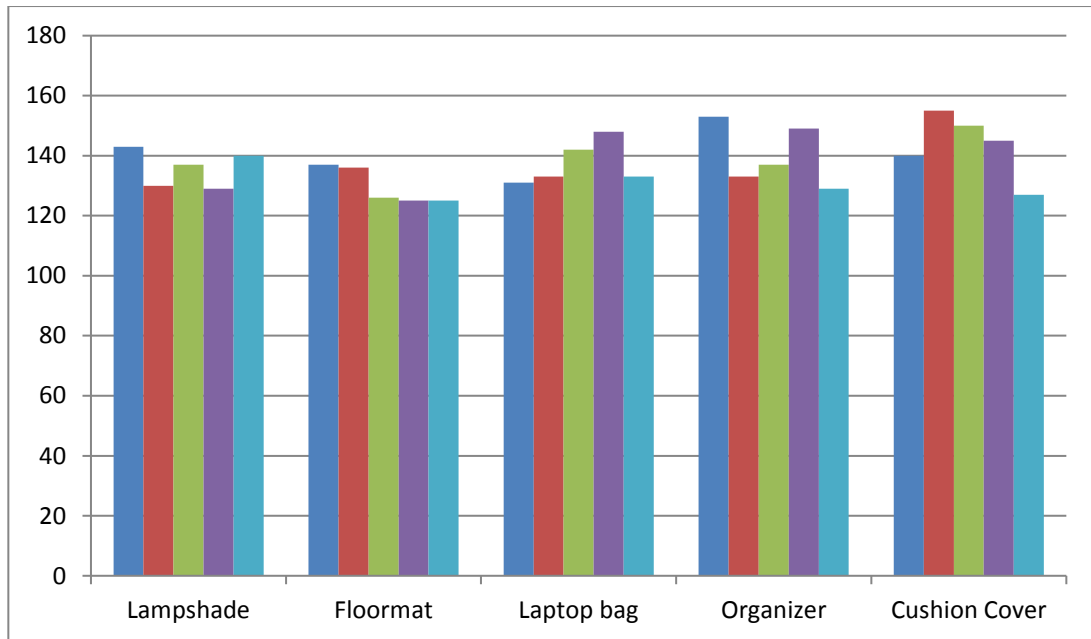


The scores obtained for the finally selected 5 designs are shown in the table 3.

SL NO	PRODUCT	POINTS (UTILITY)
	<b>Lampshade</b>	
1	LS 05	143*
2	LS 08	130
3	LS 01	137
4	LS 06	129
5	LS 07	140
	<b>Floor mat</b>	
6	FM 04	137*
7	FM 08	136
8	FM 02	126
9	FM 05	125
10	FM 01	125
	<b>Laptop Bag</b>	
11	LB 05	131
12	LB 04	133
13	LB 07	142
14	LB 06	148*
15	LB 01	133

SL NO	PRODUCT	POINTS (UTILITY)
	<b>Organizer</b>	
16	OR 05	153*
17	OR 06	133
18	OR 07	137
19	OR 08	149
20	OR 02	129
	<b>Cushion Cover</b>	
21	CC 01	140
22	CC 06	155*
23	CC 02	150
24	CC05	145
25	CC 08	127

TABLE 3- PRODUCT SELECTION



GRAPH 2 - PRODUCT SELECTION

The selected designs are Lampshade LS 05, Floor mat FM 04, Laptop bag LB 06, Organizer OR 05 and Cushion Cover CC 06

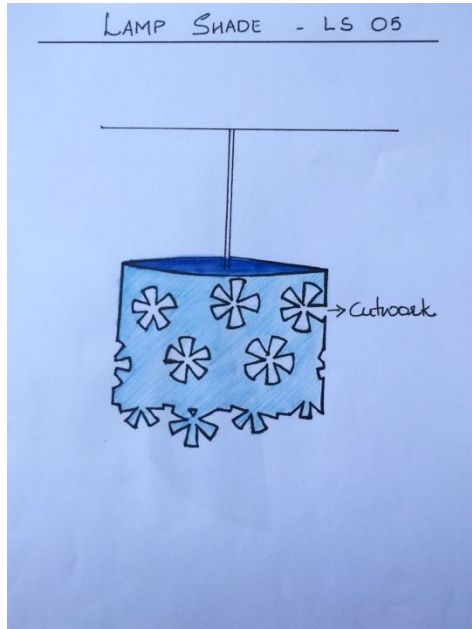


FIGURE 6 : LAMPSHADE LS 05



FIGURE 7: FLOOR MAT FM 04



FIGURE 8: LAPTOP BAG LB 06

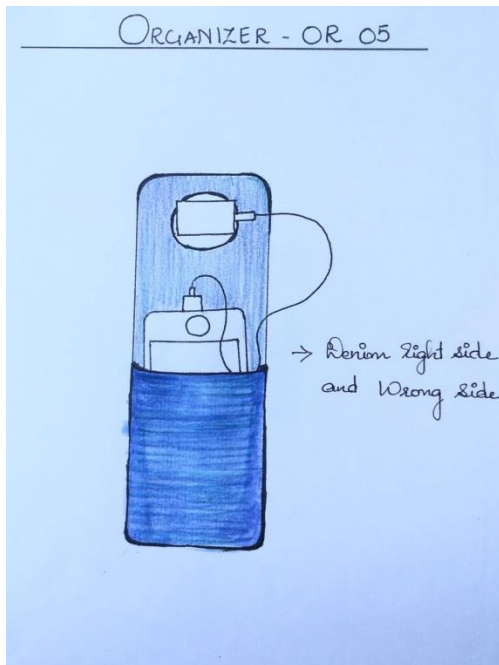


FIGURE 9: ORGANIZER OR 05



FIGURE 10: CUSHION COVER CC06

### ***DEVELOPMENT OF PRODUCTS***

Used Denim fabrics were collected from friends and family members. Trims were purchased according to the patterns and selected designs. Different Artistry methods like Appliqué work, piping, quilting and cutwork were applied.

The following products were developed:-

**LAMPSHADE LS 05**



**PLATE 4: LAMPSHADE LS 05**

**FLOORMAT FM 06**



**PLATE 5: FLOORMAT FM 06**

LAPTOP BAG LB 06



PLATE 6 :LAPTOP BAG LB 06



ORGANIZER OR 05



PLATE 7: ORGANIZER OR 05

CUSHION COVER CC 06

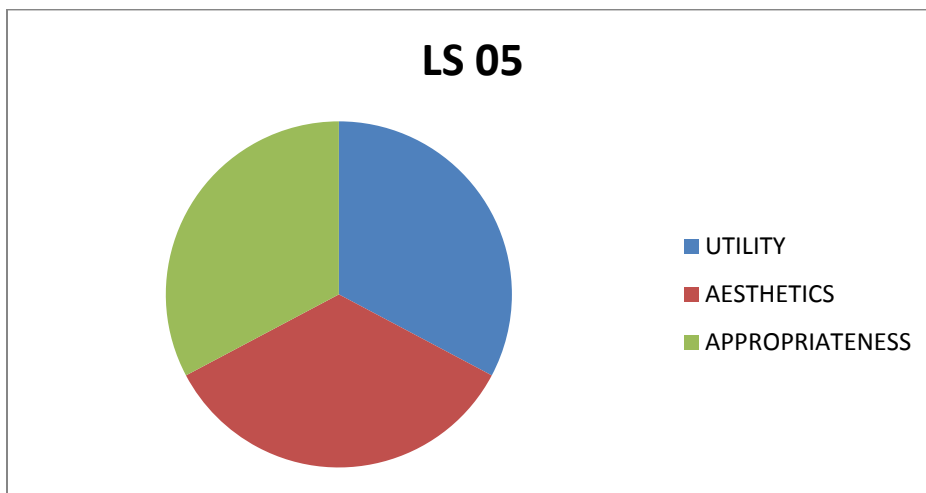


PLATE 8: CUSHION COVER CC 06

#### 4.4 COLLECTING FEEDBACK

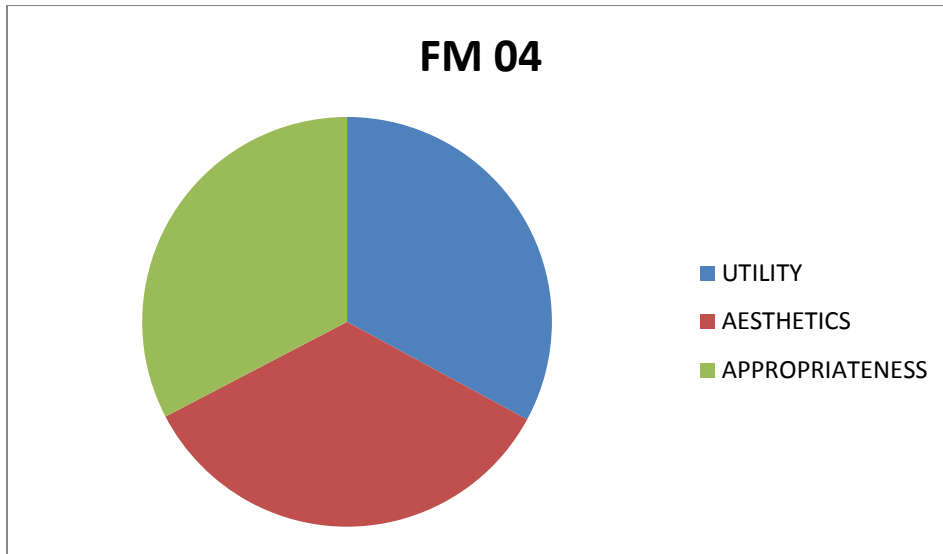
The final developed products were shown to the same 35 students of the target sample and the feedback on the products were noted down in terms of utility, aesthetic appearance, and appropriateness

#### LAMPSHADE



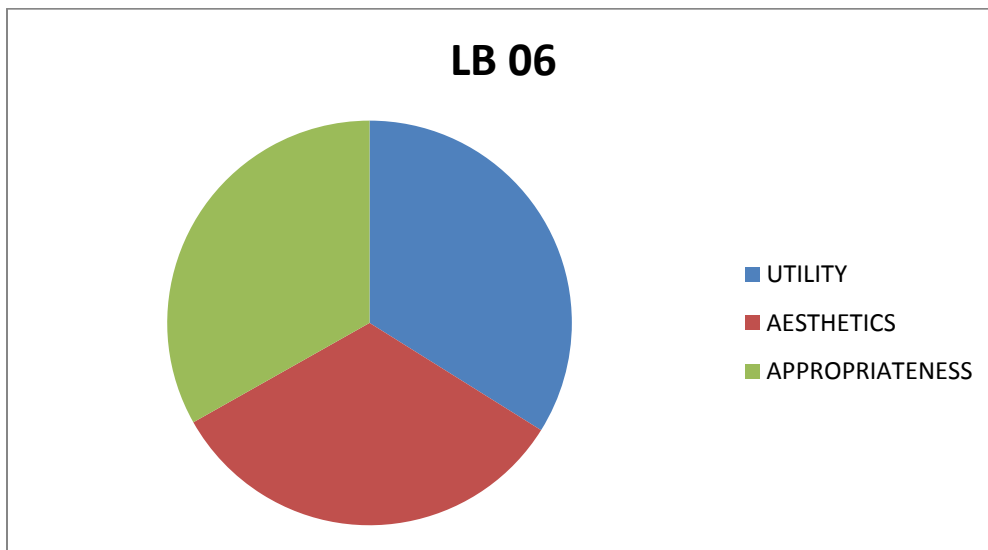
GRAPH 3: LAMPSHADE LS 05 obtained 132 points for utility, 139 points for aesthetics and 132 points for appropriateness.

## FLOOR MAT



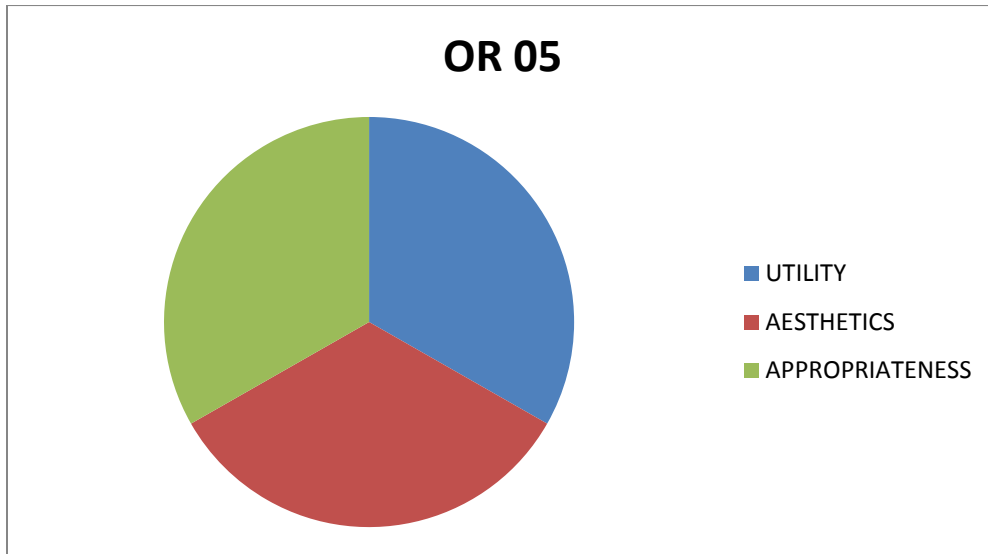
GRAPH 4: FLOORMAT FM 06 obtained 129 points for utility, 135 points for aesthetics and 128 points for appropriateness

## LAPTOP BAG



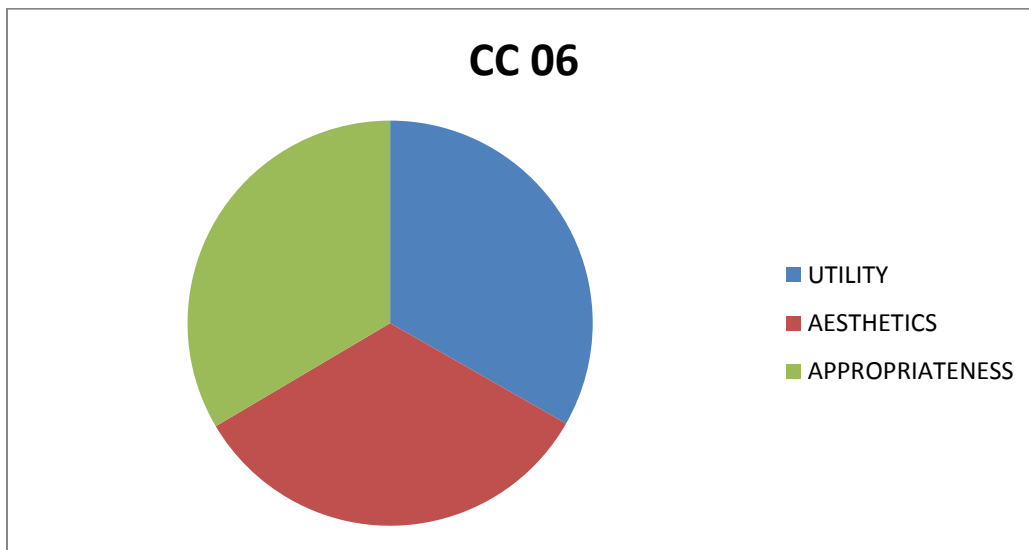
GRAPH 5: LAPTOP BAG LB 06 obtained 141 points for utility, 137 points for aesthetics and 138 points for appropriateness.

## ORGANIZER



GRAPH 6: ORGANIZER OR 05 obtained 135 points for utility, 136 points for aesthetics and 135 points for appropriateness.

## CUSHION COVER



GRAPH 7: CUSHION COVER CC 06 obtained 136 points for utility, 136 points for aesthetics and 137 points for appropriateness.

**SUMMARY  
AND  
CONCLUSION**

## ***SUMMARY***

Denim is a heavy woven fabric made of strong cotton. That is, from 100% cotton coarse indigo dyed warp and grey weft yarn. Denim is a cotton warp-faced textile in which the weft passes under two or more warp threads. A diagonal ribbing is produced from this twill weaving which distinguishes it from cotton duck. The scope for denim wear is increasing tremendously every year and its worldwide market share has increased unpredictably in the last few decades. Recently the fashion trend is moving from denim to stretch denim. Stretch denim usually incorporates an elastic component into the fabric to allow a degree of stretch ability in garments.

Denim, one of the most widely used material in the world, has significant impact on environment in manufacturing and waste management stage. Denim recycling has opened vast opportunities for savings in the use of raw materials, energy and water consumption, chemicals and auxiliaries and waste water treatment. Raising the awareness of the consumer's contribution toward sustainability and environment safety has paved the increase in recycling of not only denim but also many other materials that are used today. The focus should move toward manufacturing products without waste, and if waste occurs, it should be recycled to lead to a zero waste economy.

## **OBJECTIVES OF THE STUDY**

The researcher with the purpose of recycling denim waste into useful products has framed the following objectives:-

- To study about different brands of denim in Ernakulum city
- To collect information about the most moving brand in the existing market

- To conduct survey and understand the product preferences of reused denim
- To design and construct products from waste denim fabrics.
- To collect feedback on the finished products from the targeted group.

The samples selected for the present study were the females of age group between 20yrs to 25 yrs in Ernakulam City as it is found that this age group can make purchasing decisions of their own and also are mature enough to think about environment friendly processes like textile recycling. So more precisely the Post Graduate students of St. Teresa's College, Ernakulam were selected as the target sample. A questionnaire was developed to collect information about the awareness on the different brands of denim, the most moving brand and the application of the recycling of denim if any. Also 10 numbers of products were suggested to be made from used denim.

Based on the survey five products were selected to be designed and constructed using waste denim. The five products are lampshade, laptop bag, cushion cover, organizer and floor mat. 50 designs were developed for the above mentioned five products (10 designs of each product). The designs were hand drawn. For each designs, the utility purpose, the aesthetic value and appropriateness was considered while designing the product. The first evaluation was done by the 13 teachers of Women's Study Centre, St. Teresa's College, Ernakulam. All designs were ranked according to their preferences. Five designs from each category were selected based on the highest marks scored. Here Utility of the design was given more weightage and the selection was done accordingly.

The selected designs were rendered according to the fabric that was to be used for construction. A PowerPoint presentation was prepared and was shown to 35 students of the target sample in order to finalize one product in each category.



Final five designs were selected in each category according to the marks they obtained based on the aesthetic appearance and utility of the product. Paper patterns of the selected designs were developed by flat pattern making method. The designs were cut on the disposed denim clothing and these were constructed to make the selected products.

As per the information availed from the survey it was found that the target group were aware of the denim brands like Levi's, Denizen, Wrangler, Jack and Jones, Lee etc and the most moving denim brands in Ernakulam are Levi's, Lee Cooper and Wrangler. Most of the students gave away their denim clothing to their younger ones. From the 10 products suggested for making, using disposable denim, 5 products were selected as per the preference of the target group. The products suggested were lampshade, laptop bag, cushion cover, pouch, organizer, accessories, bean bag, backpack, footwear and floor mat.

The score obtained by the products are shown in the table 1.

<b>SL NO:</b>	<b>PRODUCT</b>	<b>POINTS</b>
1.	LAMPSHADE	35
2.	LAPTOP BAG	44
3.	CUSHION COVER	66
4.	POUCH	34
5.	ORGANIZER	35
6.	ACCESSORIES	18
7.	BEAN BAG	21
8.	BACKPACK	22
9.	FOOTWEAR	32
10.	FLOORMAT	61

10 designs were developed for each of 5 products. Totally 50 designs were hand drawn. Design code was given to each design.50 designs were evaluated and 5 designs of each product were selected by 13 teachers of Women’s Study Centre, St. Teresa’s College, Ernakulam on the basis of the utility of the product. These 25 designs were designed and rendered according to the color of the fabric going to be used and these were again evaluated by the 35 Post Graduate students. Final 5 designs were selected on the basis of its utility and aesthetic appearance (1 design from each product category).

The selected designs are Lampshade LS 05, Floor mat FM 04, Laptop bag LB 06, Organizer OR 05 and Cushion Cover CC 06



LAMPSHADE LS 05



FLOORMAT FM 04



LAPTOP BAG LB 06



ORGANIZER OR 05



CUSHION COVER CC 06

Feedback was collected from the target group regarding the utility, aesthetics and appropriateness of the final product developed

### ***CONCLUSION***

In the current scenario there will be atleast one member in the family who would be using denim fabrics. And so the problem of disposing denim will arise in every household. Since denim is a sturdy fabric it is easy to recycle denim to other utility products. Thus it can be concluded from this study that various utility products can be developed by individuals by themselves using disposable denim and can contribute to the environment protection in a smaller way.

### ***RECOMMENDATION***

1. A study can be conducted to develop various other utility products from disposable denim.

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# **APPENDIX**

**ST.TERESA'S COLLEGE, ERNAKULAM**

**MASTER'S IN FASHION DESIGNING**

**SEMESTER IV - DISSERTATION WORK**

*Survey on denim and its recycling methods*

*Dear,*

*I am conducting a survey on the brand image of denim and the different methods of recycling denim (if any) as a part of my dissertation work of Masters in Fashion Designing. Kindly cooperate by filling this questionnaire with the correct information*

Name:

Sex:

Age:

Class:

**Branding :-**

1. What denim article do you buy?

a) pants b) jacket c) dress d) shirt e) Any other.....

2. Which brand comes to your mind first in the denim wear?

a) Levis c) Spykar b) Lee cooper d) Benetton e) Any other.....

3. Which company do you view as the leader in the denim wear?

a) Levis c) Spykar b) Lee cooper d) Benetton e) Any other.....

4. Where do you prefer shopping most for denim wear?

a) Lifestyle showrooms b) boutiques/standalone stores

5. How often do you buy branded products in case of denims?

a) Mostly c) sometimes b) Never d) can't say

6. Which brand do you prefer for denim jeans?

a) Levi's Strauss c) wrangler b) Spykar d) signature e) Any other.....

7. Which brand do you purchase the most?

a) Levi's Strauss c) wrangler b) Spykar d) signature e) Any other.....

8. What influences your choice?

a) Brand image c) Effective advertising b) Comfortable fit d) Pricing

9. How satisfied are you with the brand you are using?

a) Very satisfied c) Satisfied b) Neutral d) Dissatisfied

10. How frequent do you purchase denim products in a year?

a) Once c) Twice b) Thrice d) More than that

**Recycling:-**

11. How long do you use denim article?

a) 6 months b) 1 year c) 2-3 year d) 3-4 year e) More than 4 years

12. What do you do with worn out denim article?

a) Give to someone b) Reuse c) Dispose d) Recycle

13. Have you recycled denim?

a) Yes b) No

14. If yes, how?

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15. What products do you prefer with recycled denim?

a) Lamp shade b) Laptop Bag c) Cushion cover d) Pouch e) Organizer

f) Accessories g) Bean Bag h) Backpack i) Footwear j) Floor mat

k) Any other option you want to suggest.



	<b>5pt</b>	<b>4pt</b>	<b>3pt</b>	<b>2pt</b>	<b>1pt</b>
<b>UTILITY</b>					
<b>AESTHETIC</b>					
<b>APPROPRIATENESS</b>					

NAME:

CLASS:

DEPT: LAMPSHADE

1. LS

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

2. LS

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

3. LS

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

4. LS

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5. LS

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5pt –Excellent 4pt – Very Good 3pt – Good 2pt – Satisfactory 1pt – Unsatisfactory
---

## FLOORMAT

1. FM

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

2. FM

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

3. FM

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

4. FM

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5. FM

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5pt –Excellent 4pt – Very Good 3pt – Good 2pt – Satisfactory 1pt – Unsatisfactory
---

## ORGANIZER

1. OR

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

2. OR

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

3. OR

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

4. OR

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5. OR

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5pt – Excellent 4pt – Very Good 3pt – Good 2pt – Satisfactory 1pt – Unsatisfactory
--

## LAPTOP BAG

1. LB

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

2. LB

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

3. LB

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

4. LB

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5. LB

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5pt –Excellent 4pt – Very Good 3pt – Good 2pt – Satisfactory 1pt – Unsatisfactory
---



## CUSHION COVER

1. CC

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

2. CC

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

3. CC

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

4. CC

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5. CC

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					

5pt –Excellent 4pt – Very Good 3pt – Good 2pt – Satisfactory 1pt – Unsatisfactory
---

NAME:  
 CLASS:  
 DEPT:

5pt –Excellent
4pt – Very Good
3pt – Good
2pt – Satisfactory
1pt – Unsatisfactory

**1. LAMPSHADE - LS 05**

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					
APPROPRIATENESS					

**2. LAPTOP BAG - LB 06**

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					
APPROPRIATENESS					

**3. ORGANIZER - OR 05**

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					
APPROPRIATENESS					

**4. FLOORMAT - FM 04**

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					
APPROPRIATENESS					

**5. CUSHION COVER - CC 06**

	5pt	4pt	3pt	2pt	1pt
UTILITY & AESTHETICS					
APPROPRIATENESS					



**A STUDY ON THE DEVELOPMENT OF RECYCLED  
PRODUCTS USING DISPOSABLE DENIM FABRICS**



**DISSERTATION**

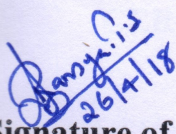
*Submitted in Partial Fulfillment of the Requirement for  
The Award of the Degree of*

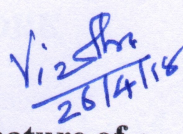
**MASTER'S PROGRAMME IN FASHION DESIGNING**

**BY  
ROSE ELSA DERRIN  
(Register Number: SM16MFD003)**

**DEPARTMENT OF FASHION DESIGNING  
ST. TERESA'S COLLEGE (AUTONOMOUS)  
ERNAKULAM**

**APRIL 2018**

  
Signature of the  
External Examiner

  
signature of  
Internal Examiner

