Faculty of Engineering
Department of Textile Engineering

STUDIES ON THE DEFECTS FOUND IN YARN DYEING

Course code: TE4214 **Course title:** Project (Thesis)

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A Thesis report submitted in partial fulfillment of the requirements for the degree

of

Bachelor of Science in Textile Engineering

Advance in Wet Processing Engineering

Spring-2024

DECLARATION

By agreeing to this declaration, we at Daffodil International University attest that Mr. Tanvir Ahmed Chowdhury, an assistant professor in the department of textile engineering within the faculty of engineering, provided advice for the completion of this study. Furthermore, we certify that neither this project nor any of its parts have ever been submitted to another institution in an effort to get a degree or certification.

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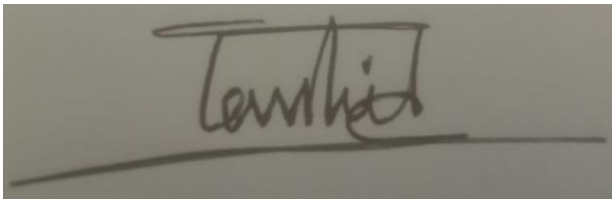

LETTER OF APPROVAL

This project report was produced by Md. Tawhid Hassan (ID: 201-23-830) approved as partial satisfaction of the prerequisites for the Bachelor of Science in Textile Engineering degree. The aforementioned students have completed their project work under my supervision. During the course of the research, I found them to be earnest, hardworking, and enthusiastic.

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ACKNOWLEDGEMENT

First and foremost, we thank the Almighty Allah for his wonderful grace, which has enabled us to successfully finish this project.

In order to complete our project report, we would like to thank Ass. Prof. Mr. Mr. Tanvir Ahmed Chowdhury, Head, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We are grateful to Mr. Tanvir Ahmed Chowdhury, an assistant professor in the department of textile engineering at the Daffodil International University faculty of engineering. Our supervisor's broad experience and keen interest in the topic of textile dyeing and finishing motivated us to finish the job. This endeavor was made possible by his never-ending tolerance, academic leadership, constant encouragement, active oversight, constructive criticism, insightful counsel, reading numerous subpar drafts and rectifying these at all levels.

In conclusion, we express our gratitude to our parents, friends, and other dear ones for their unwavering support, inspiration, and fortitude during the composition of the project report. We also want to express our gratitude to all of our Daffodil International University classmates who participated in the discussion while finishing their coursework.

DEDICATION

We dedicate this thesis (project) to our esteemed professors and parents.

ABSTRACT

This paper provides a succinct analysis of the flaws that were found throughout the yarn dyeing process during a one-year period, along with the identification of related fixes that are shown in comprehensive flowcharts. Key faults like uneven dyeing, color inconsistency, and dye fastness difficulties were shown to be common problems affecting product quality via careful observation and study. The study carefully uses flowcharts to outline the dying process, identifying key phases where flaws are most likely to arise and offering precise, doable solutions to address these problems.

The emphasis on incorporating corrective measures into the dyeing process—such as modifying chemical composition, controlling temperature, and adhering to exact processing times—is important to the findings. The study promotes preventative tactics over reactive ones, highlighting the need of a proactive approach to quality management. According to the research, dyeing quality and efficiency may be significantly improved by combining industry best practices and technical breakthroughs.

The suggested fixes, shown by flowcharts, are meant to function as a useful manual for specialists in the textile industry, facilitating the decrease of flaws and improving the general quality of the fabric. The study emphasizes the value of innovation and ongoing development in yarn dying procedures, adding to the body of knowledge in the industry and providing a useful tool for attaining excellence in textile production.

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CHAPTER-1

INTRODUCTION

1.1 Introduction:

This study is the result of a year-long inquiry on common problems in the textile industry's yarn dying sector, with an emphasis on locating, evaluating, and fixing different dyeing flaws. Notwithstanding yarn dyeing's crucial role in the creation of textiles, process mistakes usually arise and jeopardize the end product's quality, usefulness, and visual appeal. These mistakes have an impact on environmental initiatives and market competitiveness in addition to waste and rework expenses. Using a mix of technical analysis, process observation, and empirical research, a thorough investigation was carried out over the course of the preceding year to address these issues head-on and improve environmental sustainability, product quality, and process efficiency.

Objectives:

Comprehensive Defect Cataloging: To methodically recognize and record the variety of flaws that arise throughout the yarn dyeing process, such as uneven dye absorption, color inconsistency, and problems with dye fastness.

Root Cause Analysis: To comprehend the intricacies of the dyeing process and its weaknesses, this analysis looks at the fundamental reasons of these flaws, taking into account variables including chemical compositions, dyeing conditions, and fabric qualities.

Solution Development: Using the most recent developments in dyeing technology, process enhancements, and chemical treatments, to provide workable, viable solutions for the faults found.

Preventive Measures: In an effort to move from reactive to preventive quality control, proactive tactics and best practices are suggested to stop the development of frequent dyeing faults.

Process Optimization: To investigate ways to enhance the dyeing process' efficiency, cut waste, and lessen its environmental effect in order to support the textile industry's sustainability objectives.

Knowledge Sharing: To share research results and suggestions by way of thorough flowcharts and instructions, giving textile producers a useful tool to enhance their dying processes.

Impact on the Industry: To significantly improve the knowledge of dyeing problems and their solutions, which will improve the overall quality of dyed yarns and help the industry transition to more efficient and sustainable processes.

The study is to provide concrete answers and insights that can solve the urgent problems facing the yarn dyeing business, opening the door for better procedures and results, through this narrowly focused and thorough inquiry.

CHAPTER-2

LITERATURE REVIEW

2.1 Basic of Yarn dying:

Yarn dyeing refers to the act of coloring the yarns before they are used to make garments. The method of dyeing yarn happens either in hanks or via package dyeing. Package dyeing is a method where yarns are wound around perforated cones and placed into a dye vessel. The dye solution is then alternately inverted and reversed.

Figure 2.1: Yarn Dying Floor

Dye dying is the process of applying dyes to textiles to create desired colors and patterns. A vast variety of color effects and patterns are possible with this technique that are not possible with fabric or clothing dying. After that, textiles with a variety of complicated patterns, including plaids, stripes, and jacquards, are made using colored yarns.

2.2 Yarn store:

A yarn shop is a kind of retail store that specializes in offering yarn and associated materials for sale. It's also often called a yarn or knitting shop. For fiber artists including knitters, crocheters, and weavers, these shops provide a vast array of goods and services. The following are some essential elements of a yarn store:

Figure 2.2-3: Yarn Store

Yarn Variety: A large assortment of yarns in a variety of fibers (wool, cotton, silk, acrylic, alpaca, and mixes), colors, textures, and weights (from lace to quite substantial) are often available at yarn shops. They often carry yarns from individual dyers in addition to commercial brands.

Knitting and Crochet Supplies: In addition to yarn, these shops often have needles, hooks, scissors, stitch markers, and measuring tapes among other knitting and crocheting supplies. Some also sell specialized equipment like weaving looms and materials for felting.

Patterns and Books: Many yarn shops provide a large selection of books, periodicals, and knitting and crochet patterns ranging from beginner to intermediate level to help clients become inspired and guided in their jobs.

Classes and workshops: Yarn shops often provide classes and workshops for a range of ability levels, covering topics including fundamental knitting and crocheting, intricate stitch patterns, clothing creation, and finishing methods.

Community Space: Local fiber aficionados may meet in a yarn shop to chat, work on projects, and exchange tips. There are chairs and tables at a few of businesses where customers may sit and knit or crochet.

Expert Advice: Store employees, many of whom are seasoned knitters or crocheters, may provide insightful guidance on project scheduling, yarn selection, and managing challenging designs or methods.

Online Presence: To reach a larger audience, many yarn firms have an online store. Some could also continue to be active on social media in order to promote their activities, businesses, and neighborhoods.

Special Events: Yarn shops sometimes have special events such as trunk displays, knit-alongs or crochet-alongs, meet-and-greets with authors or designers, and yarn tastings.

Yarn shops not only supply supplies and equipment, but also expertise, motivation, and camaraderie, creating a feeling of community among enthusiasts. They are essential to the crafting community because of this.

2.3 Soft winding:

Soft winding is a process used in the textile industry to get yarn ready for dying. When it comes time to dye the yarn, this important step guarantees that it is in the greatest possible condition for dye absorption and consistent coloring. The following are the primary components of soft winding:

Purpose: Rewinding yarn from an unsuitable shape for dying into a suitable packing form, such a loosely coiled cheese or cone, is the primary objective of soft winding. This rewinding process not only cleans the yarn but also removes any dust, impurities, or entanglements.

Winding strain: As the name suggests, "soft" winding involves a somewhat lower strain on the yarn than "hard" winding. The lowered tension is crucial because it enables the dye to penetrate the yarn completely throughout the dying process. Uneven dying, in which the exterior layers absorb more color than the internal layers, may be caused by a too tight wind on the yarn.

Density of Yarn Packages: Soft winding produces a lower density yarn bundle, which is required for effective color penetration. The looser package structure makes it easier for the dye liquid to move between the yarn layers during the dying process.

Uniformity and Quality Control: Since variations in tension might affect the consistency of the dyeing process, care is required to ensure that the yarn is coiled uniformly throughout the soft winding process. Regular inspections and quality control methods are utilized to maintain consistency.

Dying Ready: The yarn is typically colored last, followed by delicate winding. After winding, the yarn packets are ready to be loaded into the dyeing apparatus. It is also possible to adapt the soft winding process to fit with certain dying techniques and equipment.

Efficiency and Productivity: Soft winding machines are designed to operate quickly and smoothly while managing large quantities of yarn. This leads to a more productive dyeing procedure.

Figure 2.4-5: Soft Winding Matching

A key phase in the dyeing process is gentle winding, which is necessary to produce colored yarn of the highest caliber. It ensures that the yarn is in optimal condition for full and consistent color absorption.

2.4 Batching:

In the textile business, yarn is prepared and sorted into batches prior to dying; this process is known as "yarn dyeing batching." In order to maximize resource use, guarantee uniformity in dying, and adhere to production deadlines, this step is essential. There are several crucial elements in the batching process:

Figure 2.6: Batching

Yarn Selection: Choosing the yarn that has to be dyed is the first stage in the batching process. This entails taking into account the kind of yarn (cotton, wool, or synthetic), its shape (hanks or cones), and the needed amount.

Batch Formation: A variety of criteria determine how yarn is organized into batches.

Color: Yarns that are dyed in identical hues are arranged in batches.

Yarn Type: To guarantee consistent dye absorption and processing conditions, yarns with comparable components or qualities are often batched together.

Order Requirements: To ensure that the correct quantity of yarn is dyed in the necessary colors, batching is coordinated with client orders.

Quality Check: The yarn is examined for quality prior to dyeing. This might include looking for any previous color changes, a trustworthy yarn count, and contaminants.

Weight Measurement: The yarn is weighed to ascertain the precise quantity of dye and chemicals required. It takes precise measuring to get the right color consistency and intensity.

formula Preparation: A dye formula is made based on the kind and weight of yarn. The kind and quantity of dye, solvents, and additives needed for the dying process are listed in this recipe.

Tagging and Documentation: All relevant information, including the batch number, yarn type, weight, color, and dye formula, is tagged on each batch. For quality control and traceability, the right paperwork is needed.

Dying Preparation: The yarn may need to be moved to the appropriate crates or containers, depending on the dying technique. For instance, yarn may be coiled into cones for package dyeing, or hanks can be strung on poles to achieve hank dyeing.

Scheduling: Priority, color sequences (to reduce color contamination), and dyeing machine availability are taken into consideration when determining when to dye batches.

Delivery to Dyeing department: After batching, the yarn batches are sent to the dyeing department, where the dying process is finished.

Batching yarn dyeing is a crucial phase in the dyeing process that guarantees the dying is completed effectively, affordably, and in accordance with the necessary quality requirements. The textile manufacturing business has several demands, and meeting those expectations requires careful planning and coordination.

2.5 Yarn dying process:

In the textile business, yarn dyeing is the process of adding color to yarns prior to their weaving or knitting into textiles. This stage in the production of textiles is essential because it makes it possible to create textiles with complex designs and a wide range of colors. Below is a summary of the yarn dyeing procedure:

Figure 2.7-8: Yarn Dyeing Matching

2.5.1 Yarn Types:

Natural fibers like cotton, wool, and silk as well as synthetic fibers like polyester and nylon may all be dyed into a variety of yarn colors. The kind of yarn determines the color and dying technique.

Dye Selection Different kinds of yarn need different dyes to be used:-

Cotton and other cellulose fibers are often dyed reactively.

Acid Dyes: Perfect for silk, wool, and other protein-based materials.

Disperse Dyes: Applied to synthetic fabrics like polyester.

Basic Dye: This dye is often applied to acrylic fibers.

2.5.2 Dyeing Types:

There are several techniques for dying yarn, and each produces the desired results and is most effective when applied to certain kinds of yarn:

Skein (or Hank) Dyeing: This method works best for small quantities and artisanal dyeing since it dyes yarns while they are still in their skein form.

Package Dyeing: Yarn is twisted into a tiny perforated tube and then colored. Large volumes of dye may be successfully colored with this process.

Beam Dyeing: This method of package dyeing involves winding yarns onto a beam, which is then colored. This works well for big quantities.

Space Dyeing: This technique creates a varied pattern by applying many colors throughout the yarn's length.

2.5.3 Dyeing Process:

Preparation: Yarns are cleaned in order to get them ready for dyeing. Bleaching is used for lighter colors, while scouring is used to get rid of impurities.

Dying: To ensure that the color penetrates the strands, the yarn is immersed in a dye bath. Some of the factors that are rigorously regulated include time, pH, and temperature.

After-Treatment: The yarn is cleansed to get rid of any leftover color after dying. Treatments like washing or light fastness may be used to enhance the fastness characteristics.

Drying: After dyeing, the yarn is dried.

2.5.4Inspection of Quality:

Maintaining quality control is essential throughout the duration of the dying process. This entails examining the dyed yarn for general quality, color uniformity, and light fastness.

2.5.5 Environmental Factors to Take Into Account:

Just two of the numerous resources needed for yarn dying are water and electricity. Resource efficiency, wastewater treatment, and environmentally acceptable color schemes

are the main strategies used by modern companies to reduce their negative environmental effects.

2.5.6 Request for Applications:

Dyed yarns are required for many different goods, such as apparel, textiles for the home, and industrial materials. Numerous imaginative and distinctive cloth patterns are possible using the dying process.

In order to produce the required colors and patterns while maintaining quality and sustainability, yarn dying is a complex process that requires knowledge of chemistry, textile technology, and creative sensibility.

2.6 Space dyeing:

As the name suggests, space dyeing is an inventive and distinctive method of dying yarn that involves adding several colors at random intervals or gaps along the yarn's length. This procedure gives knitted or woven materials a multicolored look with a unique, often varied pattern, adding depth and beauty. The following is a summary of the space dyeing procedure:

Figure 2.9: Space Dyeing Matching

2.6.1 Method - Dye Application: Space dyeing involves applying multiple dyes at predetermined intervals along the thread, as opposed to traditional dyeing methods that dye the yarn evenly in a single hue. These gaps might show a pattern or be random.

Dye Application: There are several techniques for applying dye, including spray painting, hand painting, and utilizing a dyeing machine equipped with attachments that enable accurate dye application.

2.6.2 Color Types: The yarn fiber determines the colors selected. Reactive dyes are used to color cotton, acid dyes are used to color wool, and dispersion dyes are used to color synthetic materials like polyester.

2.6.3 Yarn Types: Space dyeing is an effective method for dying both natural and synthetic fibers, such as silk, cotton, and wool. This method is especially well-liked for yarn intended for hand knitting.

Patterns & Patterns - Space dyeing produces distinctive, sometimes surprising patterns, which is the major factor in its popularity. There are many effects that may be produced by sudden or slow shifts in color. When knitted or woven, the colorful yarn may result in stripes, speckles, or more intricate color patterns.

Applications - Because space-dyed yarns provide distinctive color effects that are difficult to obtain with conventional dying techniques, they are widely utilized in fashion and home textiles. They are often used in furniture, knit textiles, shawls, socks, and ornamental items.

2.6.4 Considerations: Color Control: Because the dyeing process is less uniform than other procedures, it may be difficult to get consistent results.

Weaving and Knitting: The knitting or weaving pattern employed will determine exactly how the space-dyed yarn will look in the finished product.

Environmental Impact: Water, electricity, and dye use must all be taken into account, just as in other dyeing processes. The necessity of using environmentally friendly materials and colors is rising.

Yarn dyeing using space dyeing gives you a ton of creative freedom and individuality. The resultant multicolored yarns are popular among artisans and in the manufacture of commercial textiles because they give textiles a distinctive character.

2.7 Hydro extraction:

Hydro extraction, also known as centrifugal extraction, is a method used in the textile industry, particularly in yarn and fabric dyeing operations, to remove excess water from skeins or fabrics after they have been cleaned and dyed. This process is required to ensure efficient drying and maintain the quality of the yarn or fabric. Below is a summary of the hydro extraction process:

Figure 2.10-11: Hydro Extraction Matching

2.7.1 Principle:

Centrifugal Force: Centrifugal force is used in hydro extraction to remove water. Water is forced out of yarn or fabric by centrifugal force when it is placed in a rapidly spinning machine.

2.7.2 Process:

Loading: Following the dyeing and washing processes, the wet yarn or fabric is put into the hydro extractor, a machine that looks like a high-speed centrifuge.

Spinning: As the machine spins quickly, centrifugal force is produced that pushes water out of the yarn or cloth. The water flows through the perforated walls of the basket and is collected for treatment or disposal.

Unloading: After the cycle is finished and a significant amount of water has been removed, the yarn or cloth is removed from the extractor.

2.7.3 Advantages:

Efficiency: Hydro extraction significantly reduces the moisture content of yarns or fabrics, which facilitates a quicker and more energy-efficient drying procedure.

Quality Preservation: Reduced drying time means that the yarn or fabric is less susceptible to heat damage, preserving its properties.

Water Elimination: Water has to be extracted efficiently, especially from heavy or sensitive materials that might retain a lot of moisture.

2.7.4 Equipment: Hydro extractors come in a range of sizes and designs, depending on the kind and quantity of material being processed. They are usually made of stainless steel to resist high-speed rotation and corrosion.

Safety Considerations: Due to the high speeds involved, hydro extractors need to be securely secured and balanced. Safety precautions are necessary to prevent mishaps.

Environmental Aspect - Although hydro extraction is a mechanical process that doesn't include heat or chemicals, it reduces the energy required for drying, which helps the environment remain sustainable.

Hydro extraction, which efficiently eliminates excessive water from yarns and fabrics to prepare them for drying, is an essential step in the post-dyeing process. It enhances the

overall effectiveness of the textile manufacturing process and aids in maintaining the quality of the final product.

2.8 Drying:

It seems that you are referring to the yarn's processing as "drying". In the production of textiles, drying is an essential phase, particularly after yarn dyeing and hydro extraction. The yarn has to be dried in order to eliminate any residual moisture after it has been colored and the surplus water removed (typically via hydro extraction or centrifugal spinning). Setting the dye and getting the yarn ready for future uses—like knitting or weaving—are the tasks of this stage.

Figure 2.12-13: Dryer Matching

2.8.1 Drying Method:

Tumble Drying: This process involves tossing the yarn in a hot air atmosphere, like to using a tumble dryer at home. It works quite well with heavier yarns.

Radio Frequency Drying: This method heats and dries the yarn by using high-frequency electromagnetic waves. It is exactly controllable and efficient.

Infrared Drying: By heating the yarn with infrared radiation, the water is evaporated. This is a fast and low-energy technique.

Hot Air Drying: The moisture in the yarn is removed by a hot air stream. This is a widely used technique that works well with many kinds of yarn.

Can Drying: Yarn packs are laid out on cylindrical cans with holes in them, and hot air is blown through them. For fragile yarns, this gentle approach works well.

Vacuum Drying: By sucking out moisture, this method allows drying at lower temperatures while lowering the danger of heat damage.

2.8.2 Drying Considerations:

Temperature Control: Temperature control must be maintained to avoid yarn damage. Particularly synthetic yarns are susceptible to melting or deforming at high temperatures.

Even Drying: To preserve the yarn's quality and avoid problems like uneven coloring or texture, it is important to make sure that it dries uniformly.

Yarn kind: The kind of yarn is an important factor to take into account when determining the drying settings and process. For instance, gentler drying conditions are required for delicate fabrics like silk or wool than for harder textiles like polyester or cotton.

Energy Efficiency: Since drying operations may need a lot of energy, using efficient procedures lowers expenses and their impact on the environment.

Processing After Drying After drying, yarns may go through further processing like conditioning to bring back the ideal moisture level or softening agents.

One of the most important steps in the creation and finishing of yarn is drying, which affects the yarn's ultimate quality. The beneficial qualities of the yarn, such as color, texture, and strength, are preserved by appropriate drying, preparing it for the market or further textile production operations.

2.9 Hard winding:

Hard winding, sometimes referred to as machine winding or precision winding in the textile industry, is the act of carefully stacking and managing the tension of yarn as it is wrapped onto a cylindrical object, frequently a tube or cone. To create yarn packets for a variety of downstream tasks, including knitting or weaving, this process is necessary. An overview of the yarn hard winding procedure is given below:

Figure 2.14-15: Hard Winding Matching

2.9.1 The Procedure's Step:

Yarn Supply: A spinning frame or an additional yarn supply is required to get started. It is common practice to loop the continuous strand of yarn using a bobbin.

Yarn Tensioning: To maintain a consistent tension, the yarn is threaded through tensioning equipment. To prevent uneven winding and maintain the integrity of the yarn bundle, the appropriate tension must be used.

Yarn Layering: Using yarn, the cylindrical container is painstakingly and precisely crocheted. The layers are placed uniformly, and the winding pattern is closely inspected to prevent snarls, knots, or other anomalies.

Cone or Tube Formation: To create a cylindrical container, the yarn is looped around a cone or tube. The preferences of the end user and the specifications of the downstream processes dictate the kind of package that should be selected.

Package Formation: The coiled yarn accumulates in layers as the wrapping continues, giving the package its structure. To get the required package attributes, the winding density may be adjusted.

Monitoring and Quality Control: Systems for monitoring are in place to keep an eye out for fluctuations in tension, abnormalities, or breakage in the yarn throughout the hardwinding process. Quality control procedures guarantee that the finished product satisfies all requirements.

Yarn Splicing (Optional): To attach the end of one yarn packet to the beginning of another without interrupting the winding process, automated yarn splicing devices may be used in certain circumstances. Continuous production is simpler to get as a result.

2.9.2 The justification for hard winding:

Package Uniformity: Creating yarn packages with consistent tension, stacking, and density is the main objective. This consistency is necessary for other steps, including weaving, when a constant yarn quality is required.

Efficiency: Yarn may be wound onto packages continuously and without frequent pauses due to the high efficiency of hard winding.

Package Stability: The final product has to be stable and appropriate for storage and transportation.

Minimized Yarn Breaks: To provide a seamless and continuous operation, the procedure attempts to minimize yarn breaks during winding.

2.9.3 Advantages:

Improved Weaving/Knitting Efficiency: Use tightly coiled yarn bundles to provide smooth, error-free knitting or weaving machine operations.

Reduced Downtime: By lowering the chance of yarn breakage or errors, precision winding helps to decrease downtime in later operations.

In the process of creating yarn, a crucial step called hard winding turns continuous yarn strands into sturdy bundles suitable for a range of textile uses. The textile production chain is more productive and, eventually, produces better-quality products since the process is more exact and regulated.

2.10 WTP:

When discussing textile manufacturing and environmental management, the term "WTP" often refers to "Water Treatment Plant." The textile industry depends on water treatment facilities to handle and clean water used for various processes, such as dyeing and finishing. Because textile operations require a lot of water and may have an adverse impact on the environment, effective water treatment is essential. Below is a summary of a water treatment facility used in the textile industry:

2.10.1 The Process of a Textile Industry Water Treatment Plant (WTP):

Pretreatment of Water: Before being used in textile processes, water has to be treated to remove impurities that might affect the quality of the finished product. This covers pH level correction, sediment removal, and softening.

Wastewater Treatment: After textile businesses have utilized their products, wastewater may include chemicals, dyes, and other pollutants. WTPs treat this water to remove pollutants before it is discharged or used again.

Recycling and Reuse: Advanced WTPs have the potential to significantly reduce the industry's overall water footprint by recycling treated water for use in textile processes.

Effluent Treatment: The primary goal is to treat the effluent in compliance with environmental regulations. This means reducing BOD (biochemical oxygen demand), COD (chemical oxygen demand), suspended particles, and other pollutants to levels that can be controlled.

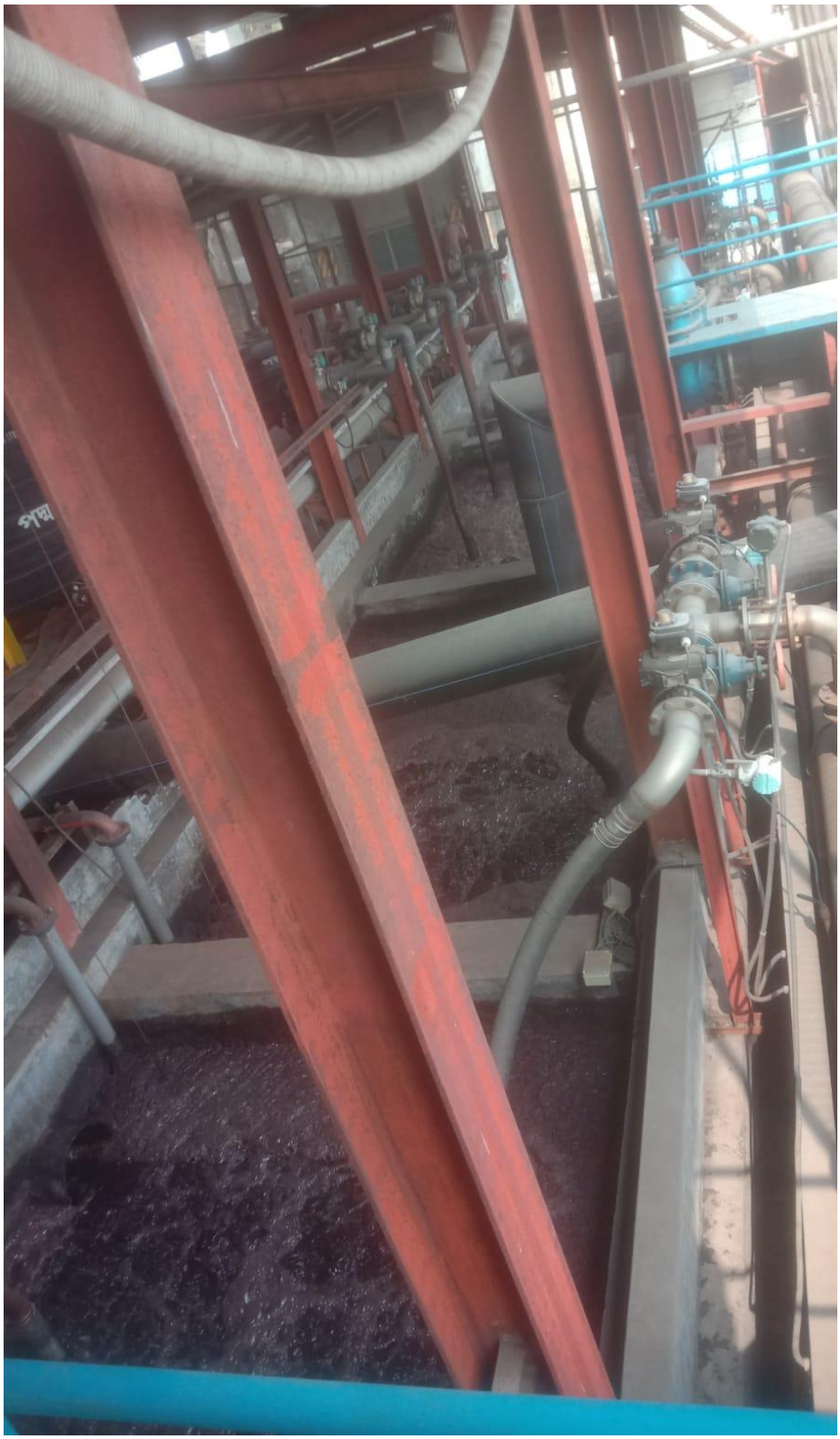


Figure 2.16-17: WTP Treatment Process

2.10.2 Stages of WTP:

Primary Treatment: Screening, flocculation, and sedimentation are physical methods used to remove suspended particles.

Secondary Treatment: Biological activities decompose organic pollutants. Typically, aerated lagoons or activated sludge technologies are used for this.

Tertiary Treatment: To further enhance the water quality if it is to be used again, more advanced treatment methods such as filtration, adsorption, and disinfection are used.

Sludge Treatment: The sludge produced during water treatment is also treated and disposed of in an environmentally friendly manner.

Figure 2.18-19: WTP Treated Water

2.10.3 Importance of (WTP) in the Textile Industry:

Environmental Compliance: Confirms that the wastewater discharge complies with local, state, federal, and international environmental requirements.

Sustainable Operations: Reduces the environmental impact of textile operations and supports sustainable methods for managing water.

Cost Savings: By using efficient water treatment and recycling methods, water use may be drastically decreased.

2.10.4 Difficulties:

High Operating Costs: Maintaining and running a WTP may be costly.

Technological Requirements: Advanced and efficient treatment techniques are required to handle the range of pollutants in textile wastewater.

Water treatment facilities are vital to the textile industry because they make it possible to manage water resources in an environmentally responsible manner. They are crucial for reducing pollution, conserving water, and ensuring that commercial activities are ecologically sustainable.

CHAPTER-3

EXPERIMANTAL DETALCE

3.1 Yarn dyeing:

Water, chemicals, dyes, and cloth all interact throughout the dyeing process. Throughout the dyeing process, many mistakes might occur for a number of causes. Dyeing yarn in a package is not like dyeing anything else. While there are many other types of mistakes that may happen throughout the package yarn dyeing process, these are the most common ones.

3.2 Yarn dyeing defects & remedies:

Defects in the yarn dyeing process may have a big influence on the finished textile goods' quality, look, and marketability. To maintain high standards throughout the dying process, it's important to be aware of these flaws and know how to fix them. The most frequent yarn dyeing mistakes are shown here, along with their corresponding fixes:

3.2.1 Uneven Dyeing:

A textile engineer has to understand color and shadow. A material might be rejected based on as little as a 5% difference in shade. As such, much care must be used while dying it. The dyeing process is continuous, and it's critical to make sure the materials' hue matches that of the standard sample. The term "uneven shade" describes the variation in color between the layers of a yarn bundle. Package yarn dyeing is known to be achieved by the dye liquid's In-0ut process. As a result, the shades in a packet may differ. The following is a list of causes of uneven shade along with its fixes.

Figure 3.1: Uneven Dyed Yarn

Causes:

- Uneven pretreatment, or uneven bleaching and scouring, comes first.
- The second is the dose of color that is off.
- The usage of dyes with strong fixing powers comes in third.
- The following step in the case of synthetic fibers is uneven heat-setting.
- Ultimately, the dyeing machine was unmanageable.

Remedy:

- First, by guaranteeing uniform pretreatment.
- Second, by making sure that synthetic fibers are heated evenly.
- Next, ensure that chemicals and colors are dosed properly.
- Finally, appropriate dyeing m/c control.

3.2.2 Package to Package Shade Variation:

The buyer's requirements are adhered to when dying. It is possible to order a little or large amount for a certain shade. Various batches are produced at the mill according on demand or machine capacity. Shade variation may thus happen from batch to batch. The following are the causes of the batch-to-batch variation and their fixes.

Figure 3.2: Package to Package Shade Variation Yarn

Causes:

- changes in the weather.
- inappropriate time to provide colors and chemicals.

- Chemical and color weight discrepancies between batches.
- differences between dye batches.
- wrong reel speed, pump speed, and liquor ratio.
- Not enough pretreatment

Remedy:

- Utilize ordinary paints and chemicals.
- Maintain a consistent ratio of alcohol to total.
- Follow the suggested pretreatment guidelines.
- Proceed with the same coloring technique.
- Apply the same coloring method to get the same shade depth.
- Make sure the process operators apply the right quantity of bulk chemicals at the right temperature and timing.
- The pH, hardness, and sodium carbonate content of the source water should be measured daily.

3.2.3 Color Fastness Problems:

Color fastness concerns in yarn dyeing refer to the dyed yarn's inability to maintain its color under various lighting, rubbing, washing, and sweating conditions. These issues might result in color fading, bleeding, or transfer, which would shorten the cloth's lifespan and make it less appealing. The list of common color fastness problems and their solutions is as follows:

Causes:

- **Wash Fastness:** Bleeding through or discoloration while cleaning.

Remedy:

- Use fixatives or other chemicals used during the post-treatment phase, optimize the dye fixation process, and use premium dyes appropriate for the yarn fiber to improve the dye-fiber bonding.

Causes:

- **Light Fastness:** When exposed to light, color fades.

Remedy:

- To preserve the dye molecules throughout the finishing process, use dyes with high light fastness ratings for the particular kind of fiber. You should also take UV absorbers into account.

3.2.4 Crease markings:

Yarn can have crease lines for a variety of reasons, which can affect the longevity and aesthetic appeal of your knitted or crocheted creations. These creases typically appear on yarn that has been twisted too tightly or left under tension for a long time.

Causes:

- The folds or creases in the yarn that appear through the lines or marks when they are dyed.

Remedy:

- Make sure the yarn is appropriately inserted into the dyeing machine, use the recommended lubricants, and adjust the dying cycle to reduce tension in order to prevent tangling and creasing.

3.2.5 Color bleeding:

When dyeing yarn, color bleeding occurs when dye accidentally seeps into adjacent yarns or into the surrounding water while the yarn is being washed. Using too much dye, failing to correctly bond the color to the yarn strands, or having certain chemicals in the water that might cause the dye to leak are some of the possible reasons of this issue.

Causes:

- When colors wash out of yarn, it results in dye fading and staining of other textiles.

Remedy:

- Make the most of the mordanting process, choose dyes that are highly soluble and affinitized for the yarn fiber, and wash everything well after dying to enhance the fixing of the color.

3.2.6 Pilling:

Yarn fibers split, tangle, and form microscopic balls or "pills" on the surface of the cloth. Pilling in yarn and knitted or crocheted items is the term for this phenomena. While pilling is not directly related to the dyeing process, some yarns and fiber types are more likely to experience it, and how yarn is dyed and treated can have an impact on both how long it lasts and how likely it is to pill.

Figure 3.3: Pilling Yarn

Causes:

- Following dyeing and subsequent usage or washing, tiny, unattractive balls of fiber form on the surface of yarn.

Remedy:

- Employ anti-pilling finishes, manage the dyeing process to reduce damage to the fibers, and choose yarns with greater twist and longer fibers.

3.2.7 Fading:

Fading, as it relates to yarn dyeing, is the progressive fading of color intensity in yarns due to a number of factors, including exposure to sunlight, frequent washings, and the chemical stability of the dyes. Because it may affect the value and aesthetic appeal of clothing that has been colored with yarn, fading is a significant issue in the production of both commercial and hand-dyed yarns.

Figure 3.4: Fading Yarn

Causes:

- The loss of color brought on by washing or exposure to light.

Remedy:

- Select dyes with exceptional ratings for lightfastness and wash fastness, and take into account post-dying methods that improve color retention.

3.2.8 Yellowing:

Yellowing is a common issue that can occur from several sources while dyeing yarn, resulting in a decrease in the appearance and quality of the dyed yarn. This problem mostly affects white or light-colored yarns, although it gradually affects darker colors as well. Understanding the reasons behind yellowing and taking preventative action are necessary to preserve the intended color integrity of dyed yarns.

Figure 3.5: Yellowing Mark Yarn

Causes:

- Unpleasant yellow yarn is often the result of either overheating or inadequate bleaching.

Remedy:

- Make sure the material is thoroughly neutralized and bleached before dying, don't use excessive heat while drying, and apply anti-yellowing chemicals as needed.

3.2.9 Chemical damage:

When yarn fibers are exposed to chemicals during the dyeing process or during aftercare, it is referred to as chemical damage in yarn dyeing. The yarn's overall look, color, and structural integrity may be impacted by this damage.

Causes:

- Deterioration or loss of yarn strength brought on by strong chemicals.

Remedy:

- Make careful you utilize protective agents, wash and neutralize chemicals properly, and optimize chemical concentrations.

3.2.10 Odor:

Both dyers and end users may be concerned about odors in yarn dyeing, which can originate from a variety of sources. The types of fabric being dyed, the chemicals employed in the dyeing process, or microbiological development after dyeing might all be to blame for the smells.

Causes:

- Unpleasant smell in the yarn after dyeing.

Remedy:

- Employ deodorizing agents, be sure to wash everything thoroughly, and keep storage areas tidy.

3.2.11 Frosting:

When patches or sections of lighter color form on the dyed yarn, giving it an uneven or frosted look, this is referred to as "frosting" in yarn dyeing. This problem is more prevalent in yarns that are dyed in rich, solid colors, and it is especially apparent in hand-dyed yarns where it is important to have consistent color saturation. Frosting is a significant problem to deal with throughout the dyeing process as it can reduce the yarn's and final textile items' visual attractiveness.

Figure 3.6: Frosting Yarn

Causes:

- Localized erosion of the surface or fading of hue.

Remedy:

- Use abrasion-resistant colors, regulate mechanical activity, and make sure handling is done gently.

3.2.12 Barre:

A typical textile fault known as "barre" in yarn dyeing is defined as recurrent, unintentional horizontal or vertical stripes or bands of color fluctuation inside a garment. This problem is not limited to colored yarns; it can also arise in textiles that are knitted or woven together from undyed or differentially dyed yarns. Barre may reduce the aesthetic and commercial value of textile items and is especially troublesome in solid-colored textiles where uniformity is sought.

Causes:

- Unwanted bands or color patterns in the yarn.

Remedy:

- Use premium dyes, keep circumstances constant, and make sure that the yarn tension and density are uniform.

3.3 Common Solutions and Optimal Approaches:

Quality Control: Make sure that every phase of the dyeing process is subjected to thorough quality control inspections.

Process Optimization: Consider the kind of fiber and intended results while regularly reviewing and adjusting dying recipes and circumstances.

Staff Training: Teach employees how to resolve frequent problems and the nuances of dying various kinds of yarn.

Maintenance: To avoid mechanical breakdowns, keep dyeing machinery and equipment clean and in excellent operating order.

Textile producers may enhance consumer happiness, minimize waste, and increase the quality of their colored yarn by concentrating on these issue.

CHAPTER-4

RESULTS & DISCUSSION

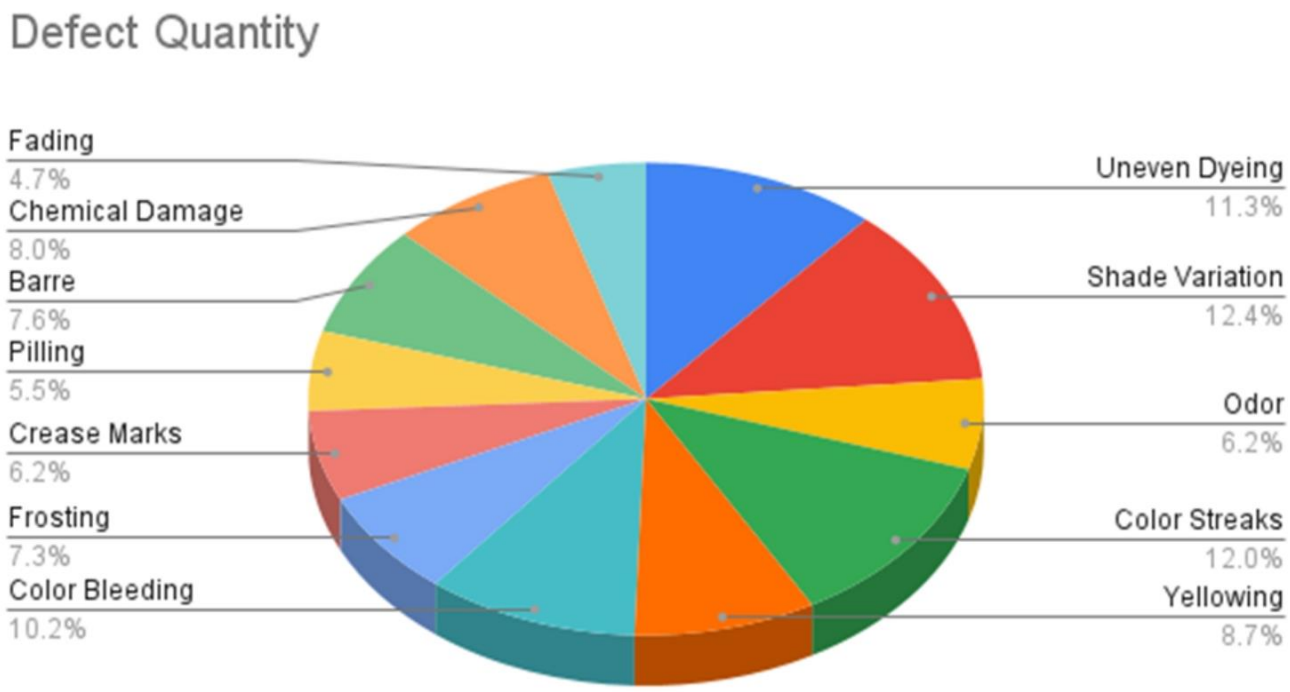
4.1 Below is a 1 year/12-month yarn dyeing defects list:

Months	Defects	Defect Quantity
January	Uneven Dyeing	5
	Shade Variation	7
	Odor	2
	Color Streaks	3
	Yellowing	6
February	Shade Variation	6
	Color Bleeding	7
	Uneven Dyeing	5
	Frosting	4
March	Crease Marks	7
	Uneven Dyeing	8
	Yellowing	4
	Pilling	5
	Barre	3
April	Color Streaks	8
	Fading	5
	Frosting	4
	Chemical Damage	6
May	Color Bleeding	9
	Odor	5

	Color Streaks	3
	Barre	6
June	Pilling	4
	Uneven Dyeing	5
	Yellowing	3
	Chemical Damage	6
	Odor	5
July	Fading	3
	Frosting	7
	Color Streaks	9
	Barre	4
August	Yellowing	7
	Crease Marks	4
	Color Bleeding	5
	Shade Variation	6
September	Barre	4
	Color Streaks	5
	Pilling	3
	Crease Marks	4
	Shade Variation	8
October	Chemical Damage	6
	Color Bleeding	7
	Yellowing	4
	Crease Marks	2

	Barre	4
November	Odor	5
	Frosting	3
	Uneven Dyeing	8
	Color Streaks	5
December	Fading	5
	Pilling	3
	Shade Variation	7
	Chemical Damage	4
	Frosting	2

4.2 Flow chart:



4.3 List of defects%:

In this flow chart, we can see 1 year defects % in yarn dyeing.

- Height % of defects in 1 year is Shade Variation **12.4%**
- Then second is Color Streaks **12%**
- Third is Uneven Dyeing **11.3%**
- Forth is Color Bleeding **10.2%**
- Then Yellowing is **8.7%**
- Then Chemical damage is **8.0%**
- Barre is **7.6%**
- Frosting is **7.3%**
- Then Crease marks & Odor is same **6.2%** each
- Pilling is **5.5%**
- Lowest 1 year defects% in yarn dyeing is Fading **4.7%**

4.4 Height % of defects in yarn dyeing is Shade Variation:

Shade variation in yarn dyeing can cause obvious variances in color shade, depth, or intensity within a batch or between batches, which can lower the quality and aesthetic appeal of the dyed yarn, especially when it's strong or "height" (substantial). This may be particularly troublesome in textiles, where uniformity is essential. Let's investigate the causes of notable shade variance and look at possible solutions to lessen these problems.

4.5 Reasons for Significant Shade Variation:

Unequal Raw Material Quality: Different natural fiber ages or synthetic fiber consistency might cause variations in the absorbency of the fiber, which can result in unequal color absorption.

Dye Lot Inconsistencies: Even when the dyeing procedure is constant, variances in the chemical makeup of dyes from one manufacturing batch to another may lead to differences in shade.

Improper Yarn Preparation: If the yarn is not sufficiently or evenly scoured, bleached, or mercerized, this might result in sections that dye differently and provide a discernible variance in shade.

Variables in the Dyeing Process: Variations in the dyeing conditions, such as temperature, pH, time, and mechanical action, can result in unequal dye fixing and penetration.

Water Hardness and Quality: The dyeing process can be impacted by the hardness and mineral content of the water, resulting in uneven colors.

Dye Exhaustion or Uneven Dye Distribution: Patchy dyeing may occur if the dye is not applied uniformly or if certain sections absorb more dye than others.

4.6 Remedies for Reducing Significant Shade Variation:

Standardization of Materials: To reduce inherent material variability, source yarns or fibers with uniform quality and make sure synthetic fibers are from the same production batches.

Strict Dye Quality Control: Use dyes from the same batch for important dye tasks, and test dye batches for uniformity and color accuracy before using.

Optimal Yarn Preparation: To guarantee that all yarns are uniformly ready for dyeing, standardize and closely monitor pre-dyeing processes including scouring and bleaching.

Accurate Regulation of Dyeing Conditions: Make use of automated dyeing apparatus capable of accurately regulating and reproducing dyeing conditions, including alcohol to water ratio, pH, and temperature.

Water Treatment: To make sure the water is constant and appropriate for the dyeing process, treat it to regulate its pH and hardness.

Leveling Agents: To encourage consistent color absorption and fixing throughout all strands, use leveling agents as needed.

Slow Dyeing Rate: By giving the dye more time to equally penetrate and bond to the fabric, a slower dyeing rate can assist create more uniform color for troublesome colors or fibers.

Post-Dye Corrections: Methods such as over-dying with a lighter shade or employing correction chemicals under careful supervision can help eliminate disparities when shade variations emerge.

Batch management: Make sure that goods intended for usage together are dyed under as comparable circumstances as feasible by carefully monitoring and recording dyeing batches.

4.7 Addressing Existing Shade Variation:

Corrective measures for yarns that have previously been dyed and show notable variations in shade are restricted, however they may consist of:

Selective Use: Use the yarn in items or areas where variations in color are acceptable or can be covered up.

Over-Dying: Although it might not always be possible or successful, over-dye the yarn with the same or a similar color to obtain a more consistent tone.

Blending: To achieve a purposefully heathered or variegated effect that seems intentional, strategically mix yarns from different dye batches or with subtle differences.

In yarn dyeing, achieving consistency is a difficult undertaking that necessitates close attention to detail throughout the whole process. Unwanted shade fluctuation may be

greatly decreased by putting strict controls in place and taking remedial action when necessary.

4.8 Lowest defects% in yarn dyeing is Fading:

Fading is usually the flaw with the lowest proportion in yarn dyeing. The term "fading" describes the fading of dyed yarns as a result of exposure to light, washing, chemicals, and other conditions that reduce the brightness or intensity of the color. Thanks to developments in dye technology and dyeing procedures, fading, though still a possibility, may frequently be reduced more successfully than other dyeing flaws such uneven dyeing, color bleeding, or shade variation. In order to attain low percentages of fading, the industry uses:

Superior Dye: Utilizing dyes with increased light and wash fastness.

Proper Dye Fixation: Ensuring that dyes are correctly fixed to the yarn fibers, which may entail selecting the optimal dye type, mordants, and fixing agents.

Post-Dyeing Treatments: Using color-fastening agents or UV protectants to improve color fastness.

Optimal Dyeing Conditions: Regulating the parameters of the dyeing process to provide the best possible dye absorption and fixing.

The textile industry continues to fade as one of the yarn dyeing faults with the lowest incidence rates by concentrating on these areas.

CHAPTER-5

CONCLUSION

5. CONCLUSION

A comprehensive year-long investigation of yarn dyeing methods identified several common defects, such as irregular dying, problems with colorfastness, and blotches or streaks. A thorough investigation and adjustment of the dyeing procedure led to the implementation of corrective measures. These included boosting yarn tension uniformity during dying, improving post-dye treatments and washes, and optimizing dye formulas and temperatures.

By implementing these changes, the quality of dyed yarn has significantly improved as evidenced by an increase in colorfastness, a decrease in flaws, and a more uniform coloration. The dyeing procedures improved the yarn's usefulness and visual appeal while also boosting the dyeing process's sustainability and productivity. It emphasizes how crucial it is for the dyeing sector to continuously evaluate, grow, and adapt in order to achieve requirements for quality and overcome obstacles.

1 year-long journey has validated the idea that the problems caused by mistakes in yarn dyeing can be successfully reduced with meticulous investigation, focused interventions, and a dedication to quality. In order to fulfill the changing needs of the textile industry, premium colored yarns that are readily available must be continuously evaluated and developed.

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FACULTY OF ENGINEERING DEPARTMENT OF TEXTILE ENGINEERING Studies On the Effect of Wet Wash on Color Fading Course code: TE 4214 Couse Title: Project (Thesis) Submitted By: Name: Ishtiak Ahmed Mahin Id: 201-23-946 Name: Proson Debnath ID: 201-23-967 Supervised By: Name of supervisor: Tanvir Ahmed Chowdhury Designation: Assistant Professor A thesis submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Textile Engineering Advance in Wet Processing Engineering DECLARATION We hereby declare that, this project has been done by us under the supervision of Tanvir Ahmed Chowdhury,Assistant Professor,Department of Textile Engineering,Faculty of Engineering,Daffodil International University.We also declare that,neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma. Ishtiak Ahmed Mahin ID: 201-23-967 Department of Textile Engineering Daffodil International University Proson Debnath ID: 201-23-967 Department of Textile Engineering Daffodil International University i LETTER OF APPROVAL This project report prepared by Ishtiak Ahmed Mahin (ID: 201-23-946) and Proson Debnath (ID: 201-23-967),is approved in Partial Fulfillment of the Requirement for the Degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING.The said students have completed their project work under my supervision.During the research period I found them sincere,hardworking and enthusiastic. Tanvir Ahmed Chowdhury ASSIATANT PROFESSOR DEPARTMENT OF TEXTILE ENGINEERING FACULTY OF ENGINEERING DAFFODIL INTERNATIONAL UNIVERSITY ii ACKNOWLEDGEMENT Firstly, we express our gratefulness to almighty Allah for his divine blessing makes us possible to complete this project successfully. We are grateful to our supervisor Tanvir Ahmed Chowdhury, Assistant Professor, Department of Textile Engineering, Faculty of Engineering, Daffodil international University.His endless patience, scholarly guidance, continual encouragement, energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting these at all stages have made it possible to complete this project. We would like to deliver thanks to our entire course mates in Daffodil International University, who took part in the discussion while completing the course work. Finally, we would like to express a sense of gratitude to our beloved parents and friends for their mental support, strength and assistance throughout writing the project report. iii This project report is dedicated to our beloved Parents and Teachers iv Abstract Washing is an impressive process of bring out the different and amazing eye catching shade and effects on the textile garments.Washing process is mainly indicates the denim garments wash.Washing can be done on fabric and garments both.But garments wash is mostly preferable for the best output of wash.The effect and shade can be bring out on the garments properly and garments wash can ensure the less damage during wash process.Firstly the garments are made from the raw fabric and then after the quality checking of sewing,the garments are ready for wash.The raw

garments are in dark shade and full of size material,which has a very rough surface of hand feeling.After different types of wash,the effect of the denim garments get a totally new look and amazing shade.Its size material also removed and softener added during the wash.Which makes the the garments handfeel very much soft and comfortable.The objective of our work was to find out the fabric quality and effect comparison of different type of wash for dark shade.For this we have to wait for the full process a from the beginning to the end to get the actual result and demanded shade of the denim garments.We started it from the raw denim garments and finishes it on the final inspection,when the garments are ready for delivary.From first to last process in washing,different types of machine,equipments,ingredients and chemicals are used.We watched the complete process of washing and noted down the process carefully. v Table of Contents Contents Declaration Letter of Approval Acknowledgement Dedication Abstract Table of Contents List of Figures List of Tables Page no. i ii iii iv v vi-vii vii-viii viii Chapter-1: Introduction 1 1.1: Introduction 2-3 Chapter-2: Lterature Overview 4 2.1: Washing machine 5 2.1.1: Washing machine's objective 5 2.1.2: Washing machine's specification 5-7 2.1.3: Washing Flowchart 7-8 2.1.4: Dry process 8-10 2.1.5: Wet process 10-12 2.1.6: Used Chemical in washing 12-13 2.2: Hydro Extractor machine 13-14 2.2.1: Hydro Extractor machine's specification 14 2.3: Dryer Machine 14-15 2.3.1: Dryer Machine's specification 15 Chapter-3: Methodology 16 3.1: Wash sample 1 17-18 vi 3.1.1: Wash sample 1 Images 3.2: Wash sample 2 3.3.1: Wash sample 2 Images 3.3: Wash sample 3 3.3.1: Wash sample 3 Images 3.4: Wash sample 4 3.4.1: Wash sample 4 Images Chapter-4: Result & Discussion 4.1: Tearing Strength Test 4.2: Color Fastness to washing 4.3: Color Fastness to Rubbing Chapter-5: Conclusion 5.1: Conclusion References 19 20-22 22-23 23-25 25 26-28 28-29 30 31 32-33 33-34 35 36 37 Table of Figures Fig 1: Tonello washing machine 6 Fig 2: Pumice Stone 11 Fig 3: Thermocol ball 11 Fig 4:Resperse Abs 12 Fig 5: Green buff 1000 powder 12 Fig 6: Sodium meta bisulphite 13 Fig 7: Organ IQ neutral 13 Fig 8: Others chemicals 13 Fig 9: Hydro extractor machine 14 Fig 10: Dryer machine 15 vii Fig 11: Wash sample 1 images Fig 12: Wash sample 2 images Fig 13: Wash sample 3 images Fig 14: Wash sample 4 images 19 22-23 25 28-29 List of Tables Table 1: Wash sample 1 Table 2: Wash sample 2 Table 3: Wash sample 3 Table 4: Wash sample 4 Table 5: Tearing strength test Table 6: Color fastness to washing Table 7: Color fastness to rubbing 18 21-22 24-25 27-28 31 32-33 33-34 viii Chapter-1 Introduction 1.1:Introduction Garment wash is a textile finishing technique that entails cleaning and washing clothing to provide particular practical and aesthetic outcomes.It is an important stage in the creation of many kinds of clothing,from casual wear to denim jeans.This extensive article offers a thorough overview of Garment Wash,covering its types,history,handling advice and profiles of leading manufacturers and users worldwide. Garment washing became fashionable as a fashion statement in the late 1960s,which is when the technique originated.Many different washing processes were developed to create the desired worn- out,distressed appearance.At first, manual procedures like sandblasting and stone washing were used. But in the decades that followed, safer and more environmentally friendly techniques were adopted as a result of worker safety and environmental concerns. There are different types of garments wash are applied in the washing factory.They are- 1. Desizing 2. Scouring 3. Enzyme wash 4. Bleach wash 5. Acid wash 6. Stone wash 7. Neutral wash 8. Over dye Every garments are not washesd in the same process and not with the same chemical.The wash are mainly depends on the demanded shade.The shade can be different for different types of denim fabric.The denim fabric has different types of characteristics. The different types of denim fabric are- 1. Organic cotton 2. BCI cotton 3. Recycled denim 4. Recycled cotton 5. Recycled polyester 6. Over dyed etc. So,these all type of denim doesn't required the same wash process to get the perfect shade.Some shade could be matched after two or three types of wash,and some shade could be mathed after all types of wash.The acid wash is very critical and lengthy processed wash.So,the shade matching is depended on the denim fabric and the wash process. Here are the objectives of the garments denim wash- 1. To remove the size material from the denim garments. 2. To make the fabric surface from rough to soft. 3. To improve the handfeel of the denim. 4. To bring out the color effect of the denim fabric and make it dark shade or light shade. 5. To make the garments charming and fashionable. 6. To make the garments comfortable to wear. 7. Washing effect can improve the color fastness to wash. So,all these objectives are found in the wash process.The wash process of denim makes the garments wearable and comfortable. Chapter-2 Litarature Review 2.1:Washing Machine Washing machine is the primary equipment of any washing factory to wash the fabric,garments and other textile materials.Washing machine is a cube box shaped machine which is powered by the electric power and there has a motor which can moves the washing machine's inner part both in forward and backward direction. In the washing machine,there has a intake pipe which fill water inside the washing machine.And there also has a exit pipe which can removes the water and chemicals from the washing machine.The washing machine is temperature controlled.So the temperature can be increase or decrease when it is needed.The door of the washing machine is hydrolic powered and the door lock is hydrolic pressed.There has a small window with a safety lock on the door of the washing machine.This is used to mix the chemicals on the washing machine. The washing machine has forward lean position.It can lean to forward direction when it is needed.In this position,the machine can exit all the washed garments from inside to outside. 2.1.1:Washing machine's objective The washing machine has different task to do in the washing factory.The main objectives are- 1. To wash garments for desizing,scouring,bleaching 2. To wash garments for enzyme washing/bio-polishing 3. To wash garments for rinsing,neutral washing,acid washing 4. To make the garments prepare for potassium permanganate wash and treating them with sponge balls 5. To over dye the white garments with various kind of dyes. So,these are the main objectives of the washing machine. 2.1.2:Washing machine's specification There was 3

types of washing machine on the washing factory.These are- 1. Tolkar washing machine 2. Tonello washing machine 3. Yilmak washing machine 1. Machine name Brand name : Washing machine : Tolkar Country of origin : Turkey Production capacity: 130 kg Power capacity : 21.5 kw Main task : Desizing,scouring,stone wash Machine speed : 17 to 20 rpm (depends on wash type) Amount of machine : 2 2. Machine name : Washing machine Brand name : Tonello Country of origin : Italy Production capacity : 150 kg Power capacity : 24 kw Main task :Scouring,bleaching,enzyme wash,acid wash,neutral wash Machine speed : 17 to 22 rpm (depends on wash type) Amount of machine : 12 Fig 1: Tonello washing machine 3. Machine name : Washing machine Brand name : Yilmak Country of origin : Turkey Production capacity : 130 kg Power capacity : 21.5 kw Main task : Scouring,bleaching,enzyme wash,acid wash,neutral wash Machine speed : 17 to 22 (depends on wash type) Amont of machine : 6 2.1.3: Washing flowchart Washing is mainly a wet processing system,but before wet processing it needs to make prepare for wet process.In that case,washing is divided in two types- 1. Dry process 2. Wet process Before wet process,the denim garments are treated with dry process and dry process are divided into 3 types- 1. 1st dry process 2. 2nd dry process 3. 3rd dry process And wet process are 2 types 1. 1st wash process 2. 2nd wash process 1st dry process is done first,then 1st wash done,after that 2nd dry process done and then the 2nd wash done,at last the 3rd dry process is applied.These process has to maintained the sequence.Each sequence has a special effect on the garments,which can be seen after the treatment. So,the washing flowchart is given below- 1st dry process- Whisker ↓ Hand brush ↓ Fusing Iron ↓ Tagging ↓ Tie ↓ 1st wash ↓ 2nd dry process- PP Laser ↓ Grinding/Destroy ↓ PP spray ↓ PP rubbing ↓ 2nd wash ↓ 3rd dry process- 3D/oven 2.1.4: Dry process The dry process are applied when the fabric is in dry situation.Dry processes can not be done on wet garments.Some main dry processes are described below- Whisker: Whisker is a design of the denim pant,which is mainly done on pant's front upper part and back knee part.Whisker is mainly done with the sand paper with the help of pattern made with the hard board.Manually this process is done. Now a days whisker can also be done with laser,which is automatic process. Hand brush: Hand brush is also done with sand paper.For hand brush,the sand paper's density is more than the whisker.Hand brush process is applied on pant's front upper part,front knee part,back pocket part,back upper part and back lower part.Hand brush can also be done with laser. Fusing Iron: Fusing iron is done the inner part of the pant's side seam,this fusing is given for bright up the wash effect on the side seam. Tagging: Tagging is mainly a plastic stapling on the denim garments,through the tagging,the tag area surface get a upper position and the wash effect can be seen on the surface after the wash process.Tagging can be done both manually and automatically.Tagging is mainly done for buyer requirement. Tie: Fabric is tied up with the rubber band and then wash.The tie process bright up the wash effect on the denim garments after wash. Laser: Laser is done with the laser,and the laser area make faded effect on the surface.It's a color burning process. Grinding/Destroy: This process is applied on the pocket,waist,bottom part.A mini air grinder is used to make the grinding.This makes the fabric specific part's surface destroyed and make soft surface. And destroy is done with destroy machine,which can make a hole or a fabric surface fully destroyed to make garments more fashionable. PP spray: Potassium permanganate spray (pp) is used to make the fabric color faded to shown the wash effect.It's mainly make the color dull or faded.With a spray gun,the pp spray is done. PP rubbing: PP rubbing is done manually with the hand,same process as the pp spray. 3D: 3D is mainly a heat process.A crease mark on the front part upper part of pant is called the 3D.It is an effect of the denim pant.This effect can be shown after 2 or 3 time wash.So,3D mark is temporary.If its need to make permenant effect,then it's need to oven work.For oven work,there used resin,and the resin make the crease marks permenant with heat.The heat can be upto 100 to 120 degree centigrade. There are also more dry processes like knee cut,hem cut,pocket image,glue patch,clip crinkle,color spot etc.But mainly described dry processes are commonly applied on the garments. 2.1.5:Wet processes Wet processe are very important to bring up the shade effect on the fabric surface.Different wet process are done for different types of shade.For dark shade,the wet process is one type and for light shade the wet process is another type.But the main wet process which are mostly applied on garments are described below- Desizing: Desizing is the size material removing process.It removes the size material and make the fabric soft and flexible. Scouring: Scouring is mainly natural impurities removing process,but in washing scouring mainly make effect on garment's fabric surface and also remove impurities. Enzyme: Enzyme wash is applied to show the used effect or fade effect of the denim garments.Enzyme wash also make the garments soft and comfortable.It removes the hairy surface of the garments. Bleaching: Bleaching is applied to remove the surface color of the garments.Mainly bleaching powder is used for the bleach wash.Bleaching wash make the garments color light. Neutral: Neutral wash is applied to neutralized the garments.Different types of chemicals are used on garments and make the garments acidic or alkalic.Neutral wash make the garments neutral by maintaining the pH which is suitable for our skin. Stone wash:Stone wash is applied with pumice stone which are rubs the garments inside the washing machine and removes the color of the fabric surface. Fig 2: Pumice stone Acid wash: Acid wash is applied on that garments,which are needed to bring out the light shade.Acid wash are normally done with thermocol ball mixed with potassium permanganate. Fig 3: Thermocol ball Rinse wash: Rinse wash is mainly washing the garments with water.This type of wash can remove all the chemicals from the garments. Tinting: Tinting is mainly the color hue of the fabric surface of the garments.The tinting can be with blue color,green color,yellow color,brown color. 2.1.6: Used chemical in washing Various chemicals are used in washing,but among them some chemicals are mostly used for different types of wash. Resperse abs- Dispersing agent Green Buff 1000 powder- Used as alkali buffer Stable Bleach- Mild bleaching agent Calsium Hypochloride- Very strong bleaching agent. Soda Ash-

Removing stains from the garments. Caustic soda- Used as detergent. Sodium meta bisulphite- Acidic condition neutralizing agent,which mainly neutralized the garments mixed with potassium permanganate. Hydrogen peroxide- Mainly bleaching agent but in washing it mostly use in scouring. Organ IQ Neutral- For using in neutralization. Potasium permanganate- Used in acid wash of denim washing Blue Breeze multi- Enzyme producing agent Fig 4: Resperse abs Fig 5: Green Buff 1000 powder Fig 6: Sodium Meta Bisulphite Fig 7: Organ IQ neutral Fig 8: Others chemicals 2.2: Hydro extractor machine Hydro extractor machine is a type of machine,which squeezes the water from the garments with centrifugal kinetic energy.When the garments are unloaded from the washing machine,the garments are full of water.This amount of water can not make the garments next process fast.Although it will take more time if it given on the dryer. So,in that case,it needs dewatering.The hydro extractor also called the de watering machine.When it is loaded with wet garments,it get covered.Then motor started,the machine started rotating.For rotation,the garments get centered for the machine's centrifugal kinetic energy and the water are get pressurized to separate from the garments.By this,the water is removed from the garments and the 90% of water are separated. Fig 9: Hydro Extractor machine 2.2.1: Hydro extractor machine's specification Machine name Brand name Country of origin Load capacity Rpm Power capacity : Hydro extractor machine : Cranch : China : 300kg :1000 : 30kw 2.3:Dryer machine Dryer machine are dried the garments which are unloaded from the hydro extractor machine.This dryer can remove all the water and dried a garments at a short time,so production rate is satisfactory.The dryer machine can be operated by gas or steam.Both can dried the water without any issues.The dryer is a big machinery in a washing factory,it's size huge and it shoud be operated with the skillfull operator. Fig 10: Dryer machine 2.3.1: Dryer machine specification Machine name Brand name Country of origin Load capacity Temperature Power capacity Operated by : Hydro extractor machine : Triveneta Grandi Impianti : Italy : 120-200kg : 135º-150º c : 5kw : Gas/steam Chapter-3 Methodology 3.1: Wash sample 1 The process needs different types of wash to gain the required shade. Here is the process flow chart- 1st wash- Desize ↓ Enzyme ↓ (Apply softener) Towel ↓ Neutral ↓ 2nd wash- PP Neutral ↓ Enzyme ↓ Tint ↓ Softener Description of the process: Here the final required shade comes after all the wash.Each and every wash has its own characteristics. Desize:Desize wash removes the size materials from the garment.Size materials are used in warp yarns to avoid the warp yarn breakage and reduce the tension during the weaving. Enzyme:Enzyme wash are applied to make the garment surface smooth and make used look on the garments. Towel wash: Towel wash mainly done for to remove the specific amount of color from the garments.Towel wash mainly done with calcium hypochloride and towel wash is done after softening. Neutral:Neutral wash firstly done to neutralize the graments,to maintain the correct pH of the garments.And secondly to make faded the garments. PP Neutral: PP is mainly potassium permanganate wash.Potasium permanganate is an acidic wash term.After pp,the garments need to neutralize,that is why first pp,the the neutral wash is done with the process. Enzyme:Enzyme wash makes the garment more used look.A denim garment can be washed with enzyme for two times.It depends on to achive the required shade of the garments. Tint:Tint is mainly a color hue.The color hue is applied on the denim garment to make the denim shade more eye catching. Softener: Softener make the garments soft and improves the handfeel of the garments. Here is the recipe for this sample of different types of wash,chemicals,doges,time,temperature and required amount of water. 1st wash Process Chemicals Doges (gm) Water Temperature Time Desize MLS ABS CAT 200 50 100 40ltr 50º 10 min Enzyme Power wash AK ABS CAT 50 50 100 50ltr 45º 35 min Towel (Softning first) Calsium hypochloride 100 40ltr Cold temp 8 min Neutral Organ IQ 200 50ltr 5 min 2nd wash PP Neutral Organ 100 5min Enzyme ACC ABS 200 50 50ltr 5min Tint GTL Yellow Black 0.7 0.2 0.2 40ltr Softener CHW 300 5min Table 1: Wash sample 1 3.1.1:Wash Sample 1 Images Raw fabric ↓ Enzyme ↓ Towel ↓ Neutral ↓ Enzyme with tint (Final shade) Fig 11: Wash sample 1 images 3.2: Wash sample 2 The process needs differenttypes of wash to gain the required shade. Here is the process flow chart- 1st wash- Desize ↓ Enzyme ↓ Bleach ↓ Neutral ↓ Thermocol ball ↓ Neutral ↓ Ozone ↓ 2nd wash- Thermocol ball (in wet) ↓ Neutral ↓ Bleach ↓ Neutral ↓ Softener Description of the process: Here the final required shade comes after all the wash.Each and every wash has its own characteristics. Desize:Desize wash removes the size materials from the garment.Size materials are used in warp yarns to avoid the warp yarn breakage and reduce the tension during the weaving. Enzyme:Enzyme wash are applied to make the garment surface smooth and make used look on the garments. Bleach:Bleach is uses to remove the denim color from the garment,to make the color light. Neutral:Neutral wash firstly done to neutralize the graments,to maintain the correct pH of the garments.And secondly to make faded the garments. Thermocol ball: Thermocol ball is applied for acid wash,potash acid is used for that. Ozone:Ozone is applied for a short time to make the garment prepare for mild shade. Softener: Softener is used to make the garments surface smooth and improve the handfeel. Here is the recipe for this sample of different types of wash,chemicals,doges,time,temperature and required amount of water. 1st wash Process Chemical Doges(gm) Water Temperature Time Desize MHS ABS 200 50 40ltr 45º 10min Enzyme Power wash AK ABS 50 50 50ltr 40º 25min Bleach Stable Bleach 35% 2kg 40ltr 40º 5min Neutral Sodium Meta Bisulphite 200 50ltr 5min Thermocol Ball Potash Acid 2 2 12min Neutral Sodium Meta Bisulphite 200 50ltr 5min Ozone 30 sec 2nd wash Thermocol ball after pp(in wet) Potash Acid 3 3 13min Neutral Organ 200 50ltr 5min ACC 100 Bleach Stable Bleach 35% 50 40ltr 45º 1min Neutral Organ 200 50ltr 5min Softener CHW 200 4min Table 2: Wash sample 2 3.2.1:Wash Sample 2 Images Raw sample ↓ Enzyme ↓ Bleach ↓ Neutral ↓ Bleach ↓ Neutal then softener (Final Shade) Fig 12: Wash sample 2 Images 3.3: Wash Sample 3 The process needs differenttypes of wash to gain the required shade. Here is the process flow chart- 1st wash- Desize ↓ Enzyme ↓ Bleach ↓ Neutral ↓ Thermocol Ball ↓ Neutral ↓ 2nd wash- PP Neutral ↓ Enzyme ↓ Softener Description of the

process: Here the final required shade comes after all the wash.Each and every wash has its own characteristics. Desize:Desize wash removes the size materials from the garment.Size materials are used in warp yarns to avoid the warp yarn breakage and reduce the tension during the weaving. Enzyme:Enzyme wash are applied to make the garment surface smooth and make used look on the garments. Bleach:Bleach is uses to remove the denim color from the garment,to make the color light. Neutral:Neutral wash firstly done to neutralize the graments,to maintain the correct pH of the garments.And secondly to make faded the garments. Thermocol ball: Thermocol ball is applied for acid wash,potash acid is used for that. PP Neutral: PP is mainly potassium permanganate wash.Potasium permanganate is an acidic wash term.After pp,the garments need to neutralize,that is why first pp,the the neutral wash is done with the process. Softener: Softener is used to make the garments surface smooth and improve the handfeel. Here is the recipe for this sample of different types of wash,chemicals,doges,time,temperature and required amount of water. 1st wash Process Chemical Doges(gm) Water Temperature Time Desize Amylese ABS CAT 200 100 100 40ltr 45º 10min Enzyme Power Wash AK ABS CAT 50 50 100 50ltr 40º 25min Bleach Stable Bleach 35% 500 40ltr 40º 5min Neutral Organ IQ 200 50ltr 5min Thermocol ball Potash Acid 4 4 1ltr 10min Neutral Sodium Meta Bisulphite 200 5min 2nd wash PP Neutral Sodium Meta Bisulphite 200 5min Enzyme ACC 100 50ltr 30min Softener CHW 500 4min Table 3: Wash sample 3 3.3.1: Wash Sample 3 Images Raw sample ↓ Enzyme ↓ Bleach ↓ Thermocol ball then Neutral ↓ Enzyme then softener (final shade) Fig 13: Wash sample 3 Images 3.4: Wash Sample 4 The process needs differenttypes of wash to gain the required shade. Here is the process flow chart- 1st wash- Desize ↓ Enzyme ↓ Scouring ↓ Ozone ↓ Thermocol ball ↓ Neutral ↓ 2nd wash Ozone(in PP) ↓ Neutral ↓ Scouring ↓ Enzyme ↓ Softener Description of the process: Here the final required shade comes after all the wash.Each and every wash has its own characteristics. Desize:Desize wash removes the size materials from the garment.Size materials are used in warp yarns to avoid the warp yarn breakage and reduce the tension during the weaving. Enzyme:Enzyme wash are applied to make the garment surface smooth and make used look on the garments. Scouring: Scouring is normally done for to remove natural impurities,and also for removing the color of fabric to make it faded shade. Ozone:Ozone is applied for a short time to make the garment prepare for mild shade. Thermocol ball: Thermocol ball is applied for acid wash,potash acid is used for that. Neutral:Neutral wash firstly done to neutralize the graments,to maintain the correct pH of the garments.And secondly to make faded the garments. Softener: Softener is used to make the garments surface smooth and improve the handfeel. Here is the recipe for this sample of different types of wash,chemicals,doges,time,temperature and required amount of water. 1st wash Process Chemical Doges(gm) Water Temperature Time Desize Mhs ABS 200 50 40ltr 45º 10 min Enzyme Power wash AK ABS 50 50 50ltr 45º 25min Scouring Soda H2O2 NCD 100 100 100 50ltr 45º 7min Ozone 2min Thermocol ball Potash 2 8min Neutral Meta 100 50ltr 5min 2nd wash Ozone(in PP) 20sec Neutral Meta 200 50ltr 5min Scouring Soda 100 50ltr 45º 5min H2O2+NCD 100+50 Enzyme ACC ABS 200 50 50ltr 45º 1min Softener CHW 100 5min Table 4: Wash sample 4 3.4.1: Wash Sample 4 Images Raw sample ↓ Enzyme ↓ Scouring ↓ Neutral ↓ Scouring ↓ Enzyme then softening(final shade) Fig 14: Wash sample 4 Images Chapter-4 Result & Discussion 4.1: Tearing Strength Test Tearing Strength Test Report For Enzyme wash- Test Repoprt Color: Dark Indigo Requirement Treatment steps Observations Result Warp 20N Desize Enzyme 78.48 76.31 Pass Weft 15N Desize Enzyme 45.14 43.62 Pass For Bleach wash- Test Report Color: Dark Indigo Requirement Treatment steps Observations Result Warp 20N Enzyme Bleach 76.32 60.29 Pass Weft 15N Enzyme Bleach 45.14 37.46 Pass For Finished product- Test Report Color: Dark Indigo Requirement Treatment Observations Result Warp 20N Bleach Finished product 60.29 56.22 Pass Weft 15N Bleach Finished product 45.14 38.99 Pass Table 5: Tensile Strength test 4.2: Color Fastness to washing For Enzyme wash Treatment- Test Method: ISO 105-C06 Color Fastness to washing Requirements Test Results Rating Color Change 4 4.5 Pass Self Stainning 4.5 4.5 Pass Color Stainning (Acetate) 4 4.5 Pass Color Stainning (Cotton) 4 4.5 Pass Color Stainning (Nylon) 4 4.5 Pass Color Stainning (Polyester) 4 4.5 Pass Color Stainning (Acrylic) 4 4.5 Pass Color Stainning (Wool) 4 4 Pass For Bleach wash treatment- Test Merthod: ISO 105-C06 Color Fastness to washing Requirements Test Results Rating Color Change 4 4.5 Pass Self Stainning 4.5 4.5 Pass Color staining (Acetate) 4 4.5 Pass Color Stainning (Cotton) 4 4.5 Pass Color Stainning (Nylon) 4 4.5 Pass Color Stainning (Polyester) 4 4.5 Pass Color Stainning (Acrylic) 4 4.5 Pass Color Stainning (Wool) 4 4.5 Pass For Finished Product- Test Method: ISO 105-C06 Color Fastness To waashing Requirements Test Results Rating Color Change 4 4.5 Pass Self Stainning 4.5 4.5 Pass Color Stainning (Acetate) 4 4.5 Pass Color Stainning(Cotton) 4 4 Pass Color Stainning (Nylon) 4 4.5 Pass Color Stainning (Polyester) 4 4.5 Pass Color Stainning(Acrylic) 4 4.5 Pass Color Stainning (wool) 4 4 Pass Table 6: Color Fastness to washing 4.3: Color Fastness to Rubbing For Enzyme Wash Treatment Test Method: BS EN ISO 105 Color Fastness to Rubbing Requirement Test result Rating Dry Crooking 3.0 4 Pass Wet Crooking 2.5 4 Pass For Bleach Wash Treatment Test Method: BS EN ISO 105 Color Fastness to Rubbing Requirement Test Result Rating Dry Crooking 3.0 4.5 Pass Wet Crooking 2.5 4.5 Pass For Finished Product Test Method: BS EN ISO 105 Color Fastness to Rubbing Requirement Test Result Rating Dry Crooking 3.0 4.5 Pass Wet Crooking 2.5 4.5 Pass Table 7: Color fastness to rubbing Chapter-5 Conclusion 5.1: Conclusion In this thesis report,it is described how different could be the faded effect of dark wash hues of the denim fabric.There is different types of dark wash and the effects are shown on the whole report.From the first to last,how the garments are making,how many process are required for washing what kind of chemicals are used for washing and what is the result of the after treatment of the garments washing,all are fully described on the report. Firstly,the dry process are done with the garments then the wet process sequencially done.From a raw fabric garments,we can get a different different amazing dark shade effect through the enzyme

wash,scouring,bleaching,neutral,pp wash,rinse wash,acid wash,thermocol ball wash,ozon process and after all the softening the garments.Softening is the last process of a denim garments washing,which mainly improves the handfeel of the garments.After the waash process,the garments are go for next process to get the certification of safety and ready for wear. Secondly,the wash fabric sample with the color fading effect is shown on this report.From the raw fabric to a finished product how the color variation is happened,that is broadly elaborated.The recipe and the time-temperature also included in that side.Anyone can easily understand the process at a glance by knowing the recipe and see the color fading of the garments. Thirdly,the test result of the garments specimen showing the strength about the fabric after wash.After wash treatment,some damages is happened due to washing.For this,the test result is important for knowing the strength value about the fabric,if it is strong enough for wearable cloths or not.If it is not,the garments can not be exported and the whole process of washing will go to for a great loss.So,to prevent this the test result is very necessary for know about the garments strength. From the washing to get the faded effect of the fabric,it is very much challenging and costly process of textile industry.All the parameters like as temperature,time,treatment,chemical,water ratio,machine revoulution everything is very important to get the final product.The color variation of the faded garments is seen on the fabric surfaces.All the data of this fading effect is collected carefully and investigate the process mainataining the time period. This study of this thesis will broad our knowledge about the color fading effect of denim wash and also will be helpful to our future workplace.This type of study can encourage our knowledge to get an ethical production of the denim wash and make sense about the production type output. References

1.https://www.textileglossary.com/terms/garment-washed.html (08.02.2024, 12:53pm)