Faculty of Engineering Department of
Textile Engineering

STUDY ON THE RE-USE OF SPENT BATH OF SCOURING & BLEACHING

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Advance in Wet Processing Technology

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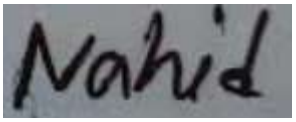
DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Tanvir Ahmed Chowdhury,Assistant Professor(Head In Charge),** 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.



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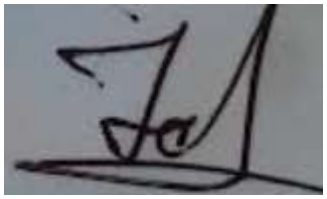

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LETTER OF APPROVAL

This project report prepared by Md. Nahid Najuse (ID: 201-23-815) and Md. Jahid Hasan (ID: 201-23-784), 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.

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This projects report is dedicated to

our beloved Parents & Teacher

ABSTRACT

This study delves into the pivotal processes of scouring and bleaching in textile manufacturing, elucidating their procedural intricacies, significance, and consequential impacts on fabric properties. Scouring, a foundational step in fabric preparation, entails the removal of natural impurities from fibers through the application of alkaline solutions and mechanical agitation. This process enhances fabric purity, brightness, and preparatory readiness for subsequent treatments such as dyeing or printing. Conversely, bleaching serves to further augment fabric whiteness by expunging residual colorants and impurities, predominantly employing oxidative reactions catalyzed by potent agents like hydrogen peroxide.The experimental methodology delineates the scouring and bleaching procedures in detail, emphasizing crucial stages including preparation, treatment, rinsing, and drying. Environmental considerations regarding proper chemical management and waste disposal are underscored to mitigate potential ecological ramifications. Furthermore, the study sheds light on the escalating adoption of automation and sophisticated methodologies in textile production, aimed at bolstering efficiency and minimizing environmental impact.The comprehensive insights provided herein aim to inform textile industry practitioners, researchers, and stakeholders, facilitating optimized manufacturing practices that prioritize fabric quality and sustainability.

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CHAPTER-1

INTRODUCTIOIN

1.1 Introduction

The process of making textiles is intricate and multi-step, converting raw fibers into finished fabrics that can be used for many purposes. Scouring and bleaching are important processes in the textile processing industry because they set the stage for other treatments including dyeing, printing, and finishing. Bleaching attempts to brighten the material's color and remove more impurities while also removing excess chemicals, waxes, oils, and natural contaminants. These pretreatment procedures are crucial to improve the quality of the fabric and guarantee the success of subsequent processes. While scouring and bleaching have been demonstrated to be effective in enhancing fabric properties, a comprehensive investigation into their impact on textile fibers prior to and following treatment is still necessary. This thesis closes this gap by comparing the properties of the cloth before and after scouring and bleaching processes. The purpose of this study is to provide information on the modifications that these processes bring about and the ways in which they impact fabric shape, mechanical qualities, dye ability, and chemical composition. Understanding how scouring and bleaching alter fabric properties is crucial to optimizing textile manufacturing operations. Certain qualities, like fabric absorbency, color fastness, and dye uptake efficiency, can be significantly impacted by scouring and bleaching procedures. Additionally, these treatments have the potential to alter the fabric's structure and surface qualities, which may have an impact on subsequent processing steps and ultimately the final textile product's quality and performance. This thesis attempts to clarify the mechanisms behind the variations in fabric properties before and after scouring and bleaching through a methodical investigation employing cutting-edge analytical techniques like scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and mechanical testing. The results of this study will not only advance our knowledge of the basic principles underlying textile pretreatment procedures, but will also offer useful guidance for maximizing scouring and bleaching procedures in order to attain desired fabric qualities and improve the textile industry's capacity to compete and survive.

1.2 Objective

- To use scanning electron microscopy (SEM) analysis to look into how the morphology of the cloth changed before and after scouring and bleaching treatments.
- To use X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR) methods to examine the changes in fabric chemical composition brought about by bleaching and scouring.
- To use mechanical testing to assess how scouring and bleaching affect the mechanical characteristics of fabric, such as stiffness, elongation at break, and tensile strength.
- To measure the water absorption characteristics of the fabric before and after treatment in order to evaluate the impact of scouring and bleaching on its absorbency.
- To use colorimetric analysis and dyeing experiments to investigate how scouring and bleaching affect cloth color fastness and dye uptake efficiency.
- To evaluate the qualities of the cloth before and after it has been bleached and scourged in order to determine the main causes of the variations in it.
- To share knowledge about how to optimize the scouring and bleaching procedures in textile manufacturing to enhance fabric performance, quality, and sustainability.
- By clarifying the mechanisms behind the impacts of scouring and bleaching on fabric qualities, to add to the body of knowledge on textile pretreatment procedures.
- To improve the textile industry's sustainability and competitiveness, the study's conclusions will be used to provide actionable recommendations for scouring and bleaching technique optimization.

CHAPTER-2

LITERATURE REVIEW

2.1 Introduction of cotton:

One of the world's oldest natural fibers, cotton is a cellulosic material that may be used for a wide range of tasks and is familiar to family members. Cotton is endowed with polyose no cellulosic materials such as sugars, starch, macromolecules, and a few inorganic substance stand. Not that it counts, but there is another polymer in cotton fiber that might be a sophisticated chemical substance. It functions as a perpetual security sale on the content.

The most widely used textile fiber in the world today is cotton. For all fibers marketed in the United States and used for clothing and home furnishings, its market share is now 56%. Private care items and nonwoven textiles are acknowledged for their additional contribution. The first since the cotton used as evidence of victimization originates from India, the present material's dating is set around 3000 B.C. Similar-aged cotton samples have also been excavated in Southern America. The first cotton-growing regions include Egypt, China, and India, and subsequently the South Pacific. Each cotton fiber consists of homocentric layers. The cuticle layer on the fiber itself is dissociable from the fiber and consists of wax and cellulose materials.

2.1.1 Properties of Cotton:

Cotton is a soft fiber that may develop around the cotton plant's seeds. Cotton fiber develops inside the cotton plant's seed capsule, or boll. Each fiber may consist of a single, long, ribbon-shaped, flat, twisted cell with a healthy lumen inside.90% cellulose,6% moisture, and the remaining lipids and contaminants. A protective coating that resembles wax is applied to the outside, giving it a sticky and fiber-like texture.

One fiber that may be fully cultivated in many nations worldwide is cotton. This crop requires sufficient temperature and moisture to grow and produce high-quality fibers. The majority of cotton is grown in warmer climates.

Cotton fibers square measure chiefly created from polysaccharide. Cellu lose doesn't kind unless temperatures square measure over seventy °F (21 °C). The cotton fibers square measure connected to the seeds within the boll of the plant. Their square measures.

There are occasionally six or seven seeds in a single boll, and each seed can have up to 20,000 fibers attached to it. The most important aspect of the cotton standard is the length of those fibers, also known as staples. Generally speaking, as the staple becomes longer, the higher the standard of the cotton. There are three categories for staple lengths: short, medium, and long (plus extra long in some situations).

Short staple cotton is between 3/8" to 15/16" (.95cm to 2.4cm) long Medium staple cotton is between 1" to 1-1/8" (2.54cm to 2.86cm) long Long staple cotton is between 1-3/16" to 2-1/2" (3cm to six.35cm) long.

2.1.2 Properties of Cotton Products:

- Comfortable – there are not any surface characteristics of cotton that create it irritating to human skin. Cotton feels sensible against skin; it's a soft hand.
- Hydrophilic – cotton incorporates a natural affinity for water – it attracts wet removed from your body.
- Moisture passes freely through cotton – aiding in evaporation and cooling
- Good Heat conduction – Cotton permits heat to dissipate creating it an exquisite fiber to keep up a snug sleeping temperature.
- Strong and abrasion resistance
- The unfavorable attributes of cotton embrace its lack of resiliency (cotton tends to wrinkle)
- lack of luster (colors area unit typically dull)

2.1.3 Characteristics of Cotton Fiber:

- Its 8% moisture recovery
- The cellulose is arranged in a way that makes cotton unique qualities of strength, durability, and absorbency.
- It is sleek, comfortable, flexible, absorbent, and free of pilling.

- It also has a decent resistance to alkalis.
- It requires a lot of upkeep, is difficult to remove stains from, shrinks easily, is less resistant to acid, abrasion, moth and mildew damage, and has poor resistance to wrinkles and shrinkage.

- The fiber length ranges from ½ to 2 inches. When wet, its strength increases by 10%. Its shape is a flat, twisted tube.

2.1.4 Chemistry of Cotton:

Cotton is Associate in Nursing insoluble substance. In some specific solvent it'll be soluble. In cotton fiber cellulose percentage is higher than different fiber. It's one quite vegetable fiber. in the main cotton fiber composed from saccharide that holds a series of aldohexose monomers. that cotton we have a tendency to get from nature it's extremely crystalline then different fiber and rigid molecular structure. Main building block of cotton cellulose chain ar ar, 4D. Free rotation of the anhydro glucose-pyranose C-O-C link is stopped by steric result. as a result of the gift of hydroxyl group teams and therefore the} chain conformation there also several bonds manufactured. Some bonds increase the rigid by increasing the rigidity of the structure of cotton fiber.

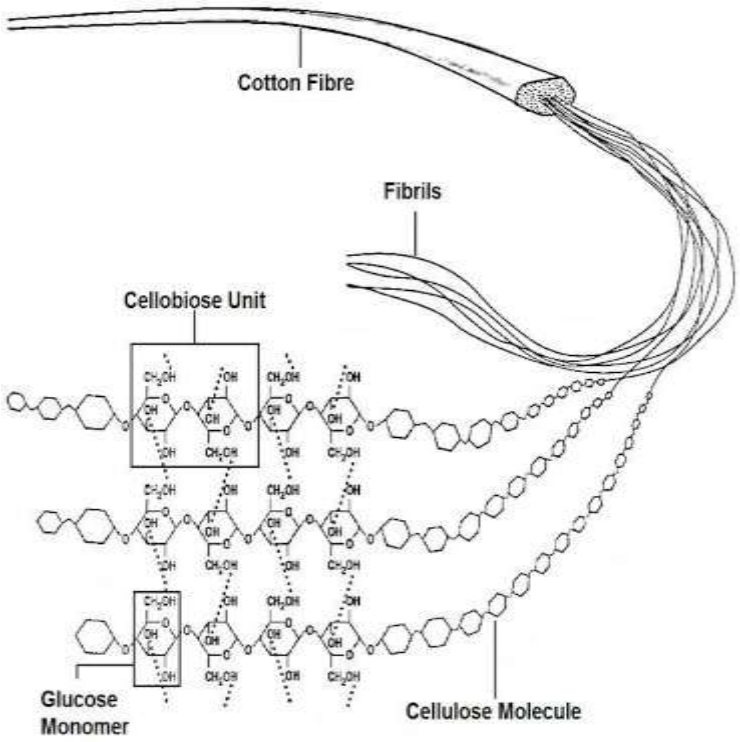

Figure 1: Chemistry of Cotton [3]

2.1.5 Chemical Structure of Cotton:

Cotton could be a natural cellulose. because it includes a common component of a vegetable cell. Proteins, oil and wax, pectose and pectins, mineral matters and natural coloring matters area unit the contents of fibre. Cotton fiber conjointly contains impurities. the share of impurities depends on the kind of cotton and fiber maturity. Immature cotton produces additional impurities than mature cotton fiber. For a dry cotton fiber.

2.1.6 Chemical components of cotton:

Table 2.1: Chemical components of cotton

Chemical	**Formation**
Cellulose	88.0-97.0
Protein	1.0-2.0
Oil & Wax	0.4-1.5
Pectins	0.4-1.5
Minerals	0.7-1.6
Others	0.5-8.0

1. Cellulose: In cotton, most quantities of elements we tend to get polysaccharide. Naturally polysaccharide consists of an aldohexose molecule that is ready in lipide technique. The mass is a pair of million more or less of the polysaccharide gift in cotton.
2. Protein: Cotton may be a macromolecule fiber. as was a common macromolecule made from polypeptides and amino acids. Those are chiefly gifts in voltaic cell walls and lumen of cloth. The assorted quantity between cell membrane and lumen is 1-2%.
3. Oil and Wax: Oil and wax are primarily hydrophobic substances. It works as a protecting coating on the fiber surface. they're from a high mass of glycerides and carboxylic acid. Waxes are going to be melted in numerous amounts. The approximate worth is sixty eight sixty eight sixty eight. once treatment (scouring)

wax faraway from fiber. Waste wax accustomed manufactures soap throughout treatment in alkaline resolution.

4. Pectin: About 0.4-1.5% pectins gift in cotton fiber. In the main these square measure from metallic elements, Mg and iron pectates with some free acid and methyl radical pectate. It's metallic element and Mg salt don't seem to be soluble in water and {also the} free acid also however in alkali hydroxides or soda they'll be regenerated into soluble products. So, throughout alkali boiling or scouring these is aloof from the cotton fiber or materials

5. Minerals: About 0.7-1.6% minerals gift in cotton fibers. These minerals are far from cotton as ash once burnt. Minerals matter other than cotton fiber as an outer surface. Minerals contain chlorides, carbonates and sulphates of potassium, metal and metallic elements. Minerals square measure removed or scale back from cotton fiber by boiling.

2.2 Woven:

Any textile created by weaving is referred to as woven cloth. Many threads are woven onto a warp and a weft to make woven fabrics, which are typically produced on a loom. Any cloth created by weaving together two or more threads at correct angles is considered weaved. Natural fibers, synthetic fibers, or a combination of the two, like cotton and polyester, can be used to create woven fabrics. Carpets, furniture, decorations, clothes, and other items are made from woven textiles.[1] In woven fabrics, threads or yarns are placed perpendicular to one another, then attached together through a pattern called "warp" and "weft". This creates fabric. Woven fabrics are produced on a loom. The loom joins two sets of yarns by weaving one set between the other. The two sets of yarns are perpendicular to each other. One set is called the warp and runs the length of the fabric.

Generally, woven fabrics are stronger and more structurally sound than non-woven fabrics. It's why they're used to make many of the items we wear on our skin: the cotton shirt, the silk of a dress, or the wool of a sweater. Woven cloth is flexible but not overly stretchy, so it is able to retain its shape well. Also, woven fabrics are strong making woven cloth well-suited to machine washing and durable use There are all kinds of different weave styles that give different types of fabrics as a result. Most of the clothing is made of using three

main types of weaves: twill, satin and plain weave. Each style has its own advantages and specific application.[2]

2.2.1 How to identify woven fabric:

Look: You can examine the fabric with a magnifying lens if you think the stitches aren't visible enough. The fibers, which are bits of yarn or thread, are woven into a crisscross pattern. One of the woven fabric's distinguishing characteristics is its basket-like weaving.

Stretch: The stretch of woven materials is minimal. The fabric will expand somewhat along its length but very little along its width if you pull on it firmly. One of the qualities that makes working with woven materials so simple is this.

Wrinkle: You can tell if your cloth is knit or woven by performing a wrinkle test. Gather a tiny portion into a fist and apply firm pressure. Should it wrinkle.

Shrink: Weaved materials do not shrink like knit fabrics do. But, you may shrink a little if you use too hot water. Using a material that has already shrunk during manufacture is the only option to keep a woven fabric piece intact. Your cloth will be more likely to shrink the larger its percentage of natural fibers, such as cotton.

Fray: Woven materials naturally unravel, causing them to fray. To stop the fabric from fraying, you should finish it with a serger or zigzag stitch. Working with your woven cloth will be much simpler as a result of this.

Warp: Depending on the situation, the word "warp" can signify many things:

The collection of lengthwise strands maintained in tension on a frame or loom in weaving is referred to as the warp. These threads serve as the basis for most woven fabrics, which are made by interlacing the weft (also known as woof) yarns perpendicular to the warp strands to form the fabric.The term "Warp" is frequently used to describe a type of fasterthan-light travel in science fiction and fantasy literature and cinema, particularly in the setting of space exploration. Spacecraft can travel faster than the speed of light thanks to a warp drive, an idea made popular by the "Star Trek" television series.

Weft: The word "weft," sometimes referred to as "woof" or "filling," is mostly used in reference to weaving:

When creating a woven fabric, the yarn or thread that is weaved horizontally across the warp (the vertical threads) is referred to as the weft. It is oriented in opposition to the warp strands. The intended weave structure dictates the pattern in which the weft is woven over and under the warp threads to create the fabric's surface.

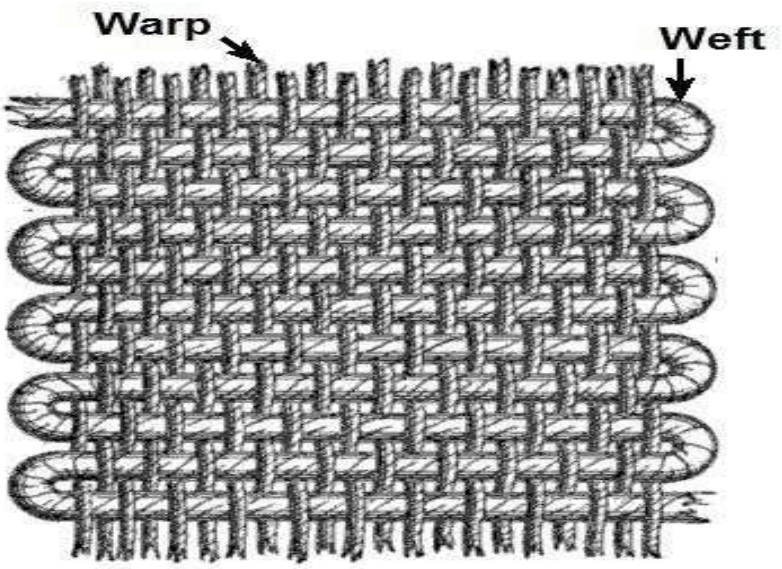

Figure 2: Warp & weft yarn sketch

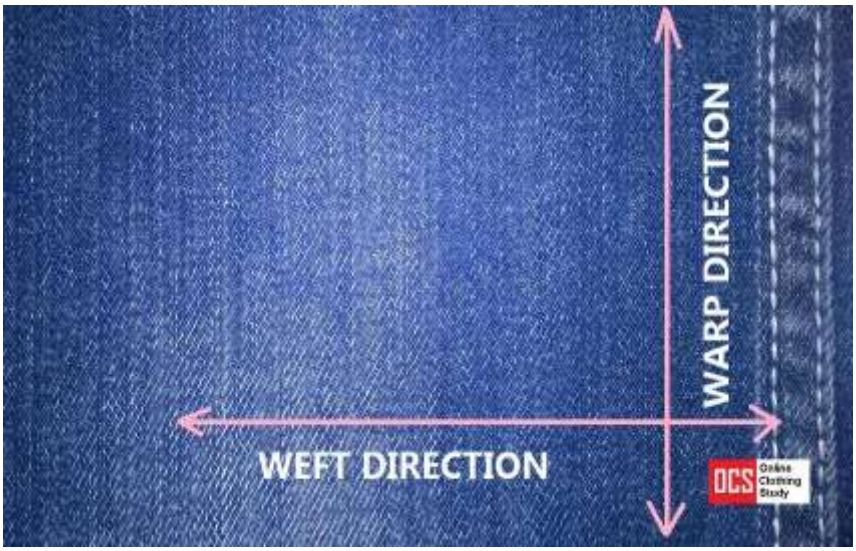

Figure 3: Warp and weft yarn in fabric

2.3 Scouring:

In the process of making textiles, scouring is a vital step that involves cleaning fibers or fabrics of impurities including dirt, waxes, and natural oils. It is usually done before more processing, such printing, dyeing, or finishing, to guarantee better fabric quality, greater performance qualities, and better dye absorption. This is a thorough rundown of the scouring procedure:

2.3.1 The Goal of Scouring:

- The main goal of scouring is to remove any impurities that can affect the end product's desirable qualities or look in order to prepare textile materials—such as cotton, wool, silk, or synthetic fibers—for further treatments.
- Enhancing the absorbency, dyeability, and general cleanliness of fibers or fabrics through scouring guarantees consistent color and finish in later processing stages.

2.3.2 Methods of Scouring:

- Chemical Scouring: In order to emulsify and solubilize contaminants, this technique uses alkaline materials such as sodium carbonate (soda ash) or sodium hydroxide (caustic soda) in combination with surfactants or wetting agents.
- Bio-Scouring: This eco-friendly method uses enzymes produced from microorganisms to break down natural contaminants (such oils, proteins, and pectin) without harming the fibers.
- Water Scouring: To remove weakly bonded pollutants and water-soluble impurities from fibers or fabrics, mechanical agitation combined with hot water is occasionally utilized.

2.3.3 Process Steps:

- Preparation: All apparent dirt, dust, or foreign particles are removed from the textile material before it is carefully cleaned and ready for scouring.

- Scouring Bath: For a predetermined amount of time, the fibers or fabrics are submerged in a scouring bath that contains an appropriate scouring agent, like alkali or enzyme, and is kept at a high temperature.

-

  Agitation: The scouring agent's penetration and the contaminants' removal from the fibers are aided by mechanical agitation, such as squeezing, stirring, or rotating the scouring bath.

- Rinsing: To ensure that the fabric is completely cleansed and free of any hazardous residues, the textile material is rinsed many times with clean water following scouring in order to eliminate any remaining scouring chemicals and contaminants.

2.3.4 The consequences of scouring:

- Elimination of waxes, natural oils, and other impurities from fibers.
- Enhanced chemical and dye penetration and wetting in later processing stages.
- Emproved the fabric's handling, softness, and absorbency.
- Enhanced whiteness and brightness of the material, particularly when it comes to cellulosic fibers like cotton.

2.3.5 Steps in the Process:

- Preparation: Using techniques like scouring or washing, the textile material is cleansed and made ready for bleaching by eliminating any surface pollutants or impurities.
- Bleaching Bath: To maximize the bleaching process, the fabric or fibers are submerged in a bleaching bath that contains the chosen bleaching agent as well as additives like stabilizers, wetting agents, or pH adjusters.
- Reaction: The colorants or chromophores in the fabric suffer chemical alterations or degradation as a result of the bleaching agent's reaction with them.
- Rinsing: To ensure that the fabric is clean and clear of any potentially hazardous residues, the bleached textile material is completely rinsed with water to get rid of any remaining bleaching agents, reaction products, and contaminants.

2.4 Impact of Bleaching:

- whitening or lightening of the fabric to give it a more radiant appearance.
- removing from the fabric any stains, discolorations, or undesirable coloring.

- Textiles are ready for further processes such as dyeing, printing, or finishing when a consistent and uniform base color is achieved.

  Enhancement of dye absorption and colorfastness in printed or colored textiles.

2.5 Different qualities between before and after scouring and bleaching:

Two popular procedures used in the textile industry to get fabric ready for dyeing or additional finishing are scouring and bleaching. What makes the difference between before and after scouring and bleaching is mostly in the goal of each phase and the state of fabric:

- In advance of scouring and bleaching:When fabric is in its raw or greige stage, it is scourged to get rid of any remaining impurities from the weaving or knitting process as well as natural impurities like oils, waxes, and dirt.

  The fabric might still have some natural pigments or contaminants after scouring, which could have an impact on the final color's consistency and brightness. With that in mind, the fabric is subsequently bleached in order to eliminate any stains, residual impurities, and natural colorants.

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- Post-Bloaching and Scouring:The cloth is completely cleaned, free of natural contaminants and colorants, and prepared for additional processing, like dyeing or printing, after scouring and bleaching.

  The fabric has superior brightness, homogeneity, and cleanliness, which puts it in a more refined state and better position to take dyes or other finishes.

  Compared to its raw or greige state, the fabric often seems brighter, whiter, and more uniform after scouring and bleaching.

2.6 Immersion Test:

- The absorbency of a fabric can be ascertained using the immersion test. A fabric sample is completely submerged in a liquid—typically water—for a predetermined amount of time during this test.
- The cloth is taken out of the liquid after the allotted amount of time has passed, and any weight gain is recorded. This weight gain is a measure of the liquid that the cloth has absorbed.

  The immersion test aids in assessing the fabric's absorbent capacity, which is crucial in figuring out whether or not it is appropriate for use in particular applications, such diapers or towels.

2.6.1 Wicking Test/ Column Test:

- A fabric's capacity to move liquid over its surface via capillary action is gauged by the wicking test. This test evaluates the liquid's (usually water's) through-the-fabric velocity.
- A fabric sample is subjected to the wicking test, wherein one end is immersed in a liquid and the other is allowed to hang loose. It is observed over a predetermined amount of time how the liquid moves through the fabric.
- When it comes to applications where moisture management is crucial, such athletic wear or medical textiles, the pace at which the liquid passes through the fabric tells us something about its wicking.

2.6.2 Drop Test/Spot Test:

- The water repellency or waterproof qualities of a cloth are assessed using the drop
- test, also called the water repellency test.
- The purpose of this test is to see how water droplets behave after being applied to the fabric's surface. Water droplets will roll off the surface and bead up on a cloth that has strong water repellency, as opposed to being absorbed.

- For applications like rainwear or outdoor apparel where protection against water penetration is necessary, the drop test is crucial in determining how well water repellent treatments applied to the fabric are working.

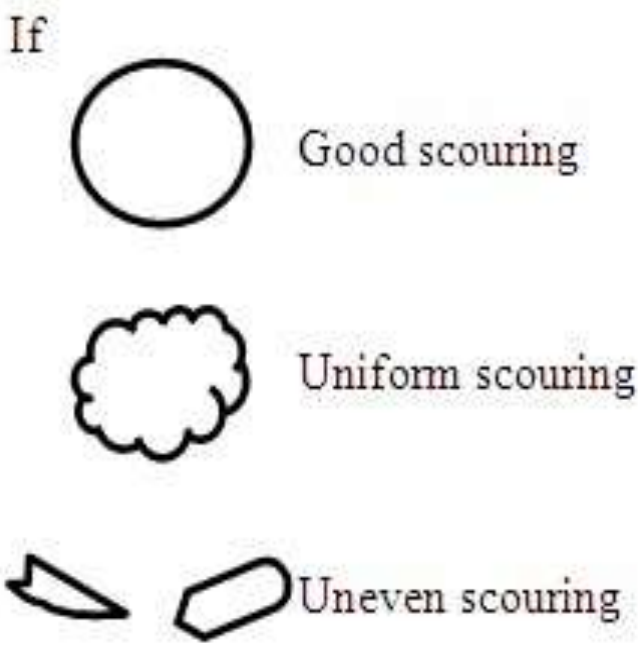


Figure 2.4: Drop Test/Spot Test

2.7 Weight loss percentage:

The calculation is as follows: number of pounds lost / beginning weight x 100.

For instance, to get your weight reduction percentage if you were 250 pounds at the beginning and recently dropped 10 pounds, use this formula: 10 / 250 x 100. This would indicate a 4% weight loss for you.

CHAPTER-3 EXPERIMENTAL DETAILS

3.1 Materials:

Table 3.1: sample specification:

Serial No	Sample Name	GSM	EPI	PPI
01	100% pure cotton(Twill)	114	124	70
02	Poplin(plain)	113	124	70

Table 3.2: chemical used in the test

Name of chemical	Purpose of use
NaOH (Sodium hydroxide)	A chemical compound having the formula NaOH, sodium hydroxide is sometimes referred to as lye or caustic soda. With sodium cations (Na^+) and hydroxide anions (OH^-) combined, it is a white solid ionic compound. At room temperature, proteins and lipids are broken down by the extremely caustic base and alkali sodium hydroxide, which can also result in dangerous chemical burns.
H2O2 (Hydrogen peroxide)	Water (H2O) plus an additional oxygen molecule (H2O2) is hydrogen peroxide. According to Dr. Beers, "the extra oxygen molecule oxidizes, which is how peroxide gets its power." This oxidation destroys microorganisms and removes color from porous materials, such as textiles.
Peroxide Stabilizer	By slowing down the hydrogen peroxide's fast breakdown, a stabilizer for hydrogen peroxide bleaching produces consistent bleaching. It serves a crucial function in producing high-quality bleached goods by inhibiting the breakdown of 2, which prevents strength loss and pinholes.

Wetting Agent	Wetting agent: chemical compound that reduces a liquid's surface tension, or the inclination of its molecules to stick together, increasing the liquid's spreading and penetrating qualities. Refer to surfactant and detergent.
Sequestering Agent	Water treatment practices frequently include sedimenting chemicals to lessen the hardness of the water. In hard water, they mix with ions of calcium, magnesium, and other heavy metals to create molecules that render the ions immobile (sequestered).

3.2 Method of Scouring and Bleaching:

In the textile production process, scouring and bleaching are necessary operations to remove impurities, oils, waxes, and natural colorants before dying or finishing, particularly for natural fibers like cotton or linen. A broad summary of the techniques used is provided here:

- Scouring is the process of cleaning a cloth or fiber to get rid of pollutants, dirt, and other impurities. Hot alkaline solutions are usually used for it.
- Preparation: The fiber or cloth is wound onto rollers or arranged in batches to undergo treatment.
- Alkaline Bath: Sodium hydroxide (caustic soda) or sodium carbonate (soda ash) are two examples of alkalis that are submerged in an alkaline solution that is often a mixture of detergents, surfactants, and alkalis. Usually, the bath's temperature is kept between 60 and 80°C.
- Agitation: Agitation methods that allow the cleaning chemicals to permeate the fabric, such as squeezing, stirring, or using ultrasonic waves, aid in the elimination of pollutants.
- Rinsing: To get rid of any last bits of chemicals and contaminants, the cloth is completely washed with water after scouring.

3.3 Bleaching:

The procedure of bleaching a cloth involves eliminating any lingering stains, natural colorants, and other contaminants. While oxidizing agents can be used in a variety of ways, this is the most popular strategy.

After the cloth has been scourged, it is cleaned and made impure-free in order to be ready for bleaching

- Bleaching Bath: Sodium hypochlorite, peracetic acid, or hydrogen peroxide are some examples of bleaching chemicals that are used in the bleaching bath for the cloth. Stabilizers, buffers, and other chemicals to regulate the bleaching process may also be added to the bleaching bath.
- Controlled Temperature: In order to hasten the bleaching reaction, the bleaching procedure is frequently conducted at high temperatures, usually between 60 and 80°C.
- Time Control: Depending on the kind of cloth, the bleaching chemicals used, and the desired level of whiteness, bleaching takes different amounts of time. It may take a few minutes or several hours.
- Rinsing and Neutralization: To get rid of any remaining bleach and balance the pH, the cloth is completely rinsed with water after bleaching. In order to protect the fabric from harm and guarantee that it is safe for additional processing, neutralization is crucial.
- Optional Brightening: To improve the whiteness and brightness of the cloth, optical brighteners or fluorescent whitening chemicals may occasionally be used.
- Drying: Lastly, techniques like air drying or mechanical drying are used to dry the bleached cloth.

3.4 Environmental Considerations:

Chemicals that are used in the scouring and bleaching procedures may be hazardous to the environment if improperly handled. As a result, it is crucial that textile producers follow

environmental laws and put policies in place for the handling and disposal of chemical waste.

3.5 Automation and sophisticated methods:

To increase the efficacy and efficiency of the scouring and bleaching processes, automated equipment and sophisticated methods are being used more and more in the textile production industry today. These might include closed-loop chemical management systems, computer-controlled equipment, and the use of less harmful bleaching chemicals for the environment.

3.6 Apparatus:

Scouring and bleaching are processes commonly employed in textile manufacturing to remove impurities and improve the appearance and feel of fabrics. Several apparatuses are used in these processes:

- Scouring Machine: This machine is used to remove natural impurities, such as oils, waxes, and other substances, from the fabric. It typically involves the use of a combination of chemicals, heat, and agitation to thoroughly clean the fabric.
- Bleaching Vat or Bleaching Machine: Bleaching vats or machines are used to apply bleaching agents to the fabric to whiten it. These machines can vary in design, ranging from simple immersion vats to more complex continuous bleaching machines that allow for efficient and uniform application of bleach.
- Padder: Padders are used to apply chemicals or bleach evenly onto the fabric. They consist of a large roller that applies pressure to the fabric as it passes through a trough containing the chemical solution.
- Jiggers: Jiggers are vessels used for batch-wise processing of fabric. They are commonly used in scouring and bleaching processes to treat smaller quantities of fabric at a time.
- Boilers or Kiers: These are vessels used for heating water and chemicals used in the scouring and bleaching process. They provide the necessary heat for activating chemicals and speeding up the cleaning and bleaching reactions.
- Washing Machines: After scouring or bleaching, the fabric needs to be thoroughly rinsed to remove any residual chemicals. Washing machines are used for this purpose, often with multiple rinse cycles to ensure complete removal of impurities and chemicals.

- Dryers: Once the fabric is cleaned and bleached, it needs to be dried before further processing. Dryers are used to remove excess moisture from the fabric efficiently.
- Neutralization Tanks: After bleaching, it's often necessary to neutralize the fabric to remove any residual bleach and adjust the pH to a more neutral level.

  Neutralization tanks are used for this purpose, typically containing chemicals such as hydrogen peroxide neutralizers or acids.

These are some of the key apparatus used in scouring and bleaching processes in textile manufacturing. The specific equipment and machinery used can vary depending on factors such as the type of fabric being processed, the scale of production, and the desired level of cleanliness and whiteness

3.7 Recipe:

Table 3.3: Recipe

Name of Chemical	Amount
NaOH	6 g/l
H2O2	4 g/l
Peroxide Stabilizer	2 g/l
Sequestering Agent	1 g/l
Sample	5 g/l
Time	60 min
Temperature	100

3.7.1 Recipe Calculation:

Total Liquer= (5*30) =150 ml

NaOH required=Total amount of liquer*recipe amount/1000

=(150*6)/1000

=0.9 ml

H2O2 required = Total amount of liquer*recipe amount/1000

=(150*4)/1000

=0.6ml

Peroxide Stabilizer= Total amount of liquer*recipe amount/1000

=(150*2)/1000 =0.3ml

Sequestering Agent=(1*!50)/1000

=0.15ml

Wetting agent= Total amount of liquer*recipe amount/1000

=(150*1)/1000

=0.15ml

Total amount of water: {150-(0.9+0.6+0.3+0.15+0.15)}

=147.9ml

3.7.2 Process Curve:

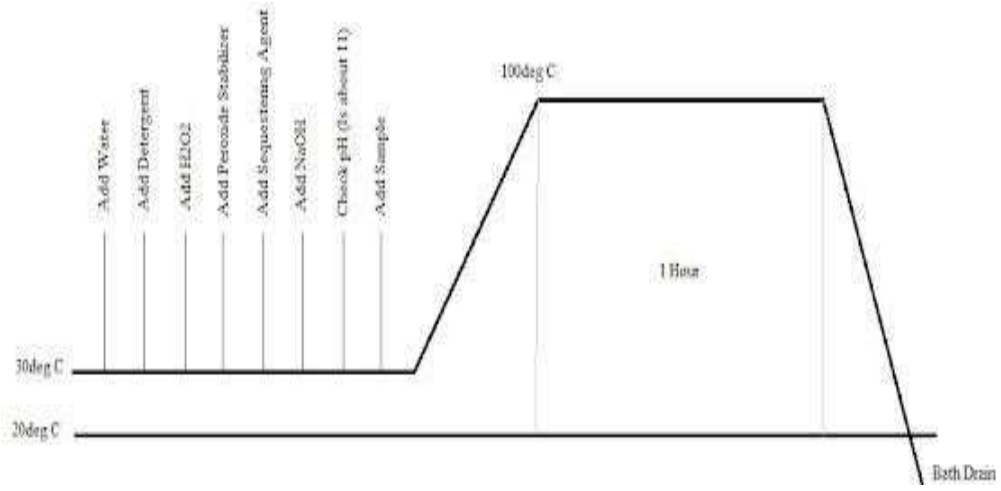


Figure 3.1: Process Curve

3.7.3 Working Procedure:

- Preparation of Fabric: The fabric to be processed is first inspected for any defects or impurities. It is then pre-treated to remove any sizing agents, oils, or other substances that may be present on the fabric surface. This can involve washing with detergents or solvents.
- Scouring: Scouring is the process of removing natural waxes, oils, and other impurities from the fabric. It is typically done using a combination of chemicals and heat. The fabric is immersed in a scouring bath containing alkaline agents such as

sodium hydroxide (caustic soda) or sodium carbonate (soda ash). Sometimes, surfactants or wetting agents are also added to aid in the removal of impurities. The fabric is then heated to a specific temperature for a certain duration to facilitate the removal of impurities.

- Rinsing: After scouring, the fabric is thoroughly rinsed to remove any residual chemicals or impurities. This step is crucial to ensure that the fabric is clean and free from any potentially harmful substances.
- Bleaching: Bleaching is the process of whitening the fabric by removing any natural or artificial colorants present. There are several methods of bleaching, including oxidative bleaching, reductive bleaching, and enzymatic bleaching. Oxidative bleaching, which is the most commonly used method, involves the use of oxidizing agents such as hydrogen peroxide or sodium hypochlorite. These agents react with the colorants in the fabric, breaking them down into smaller, colorless molecules. The fabric is immersed in a bleaching bath containing the bleaching agent, and the reaction is typically facilitated by heat and/or agitation.
- Neutralization: After bleaching, the fabric is usually neutralized to remove any residual bleaching agents and adjust the pH level of the fabric. This is typically done by rinsing the fabric with an acidic solution, such as acetic acid or citric acid, followed by another round of rinsing with water.
- Rinsing and Drying: Finally, the fabric is thoroughly rinsed to remove any remaining chemicals and dried. Depending on the specific requirements of the fabric, it may be air-dried or passed through a drying machine.

Throughout the scouring and bleaching process, it's essential to closely monitor various parameters such as temperature, pH, and chemical concentrations to ensure consistent and effective treatment of the fabric.

CHAPTER-4 DISCUSSION

OF RESULTS

4.1 Testing Evaluate:

4.1.1 Drop Test:

After scouring and Bleaching prepared a solution of 50 ml water with 0.5 gm reactive dye(red). Then take a dropper then put one drop on the surface of scouring bleaching fabric.

Here are some requirements. If its full fill the requirements then it's well scoured.

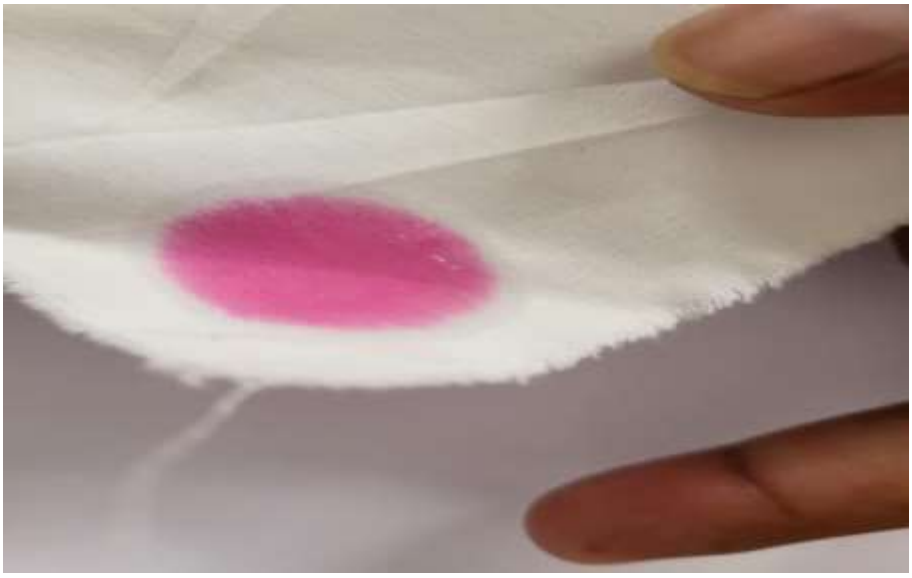


Figure 4.1: Drop Test

Drop test: Before using re-use bath Scouring and Bleaching

Drop Test: After using re-use bath

Drop test: After Scouring and Bleaching

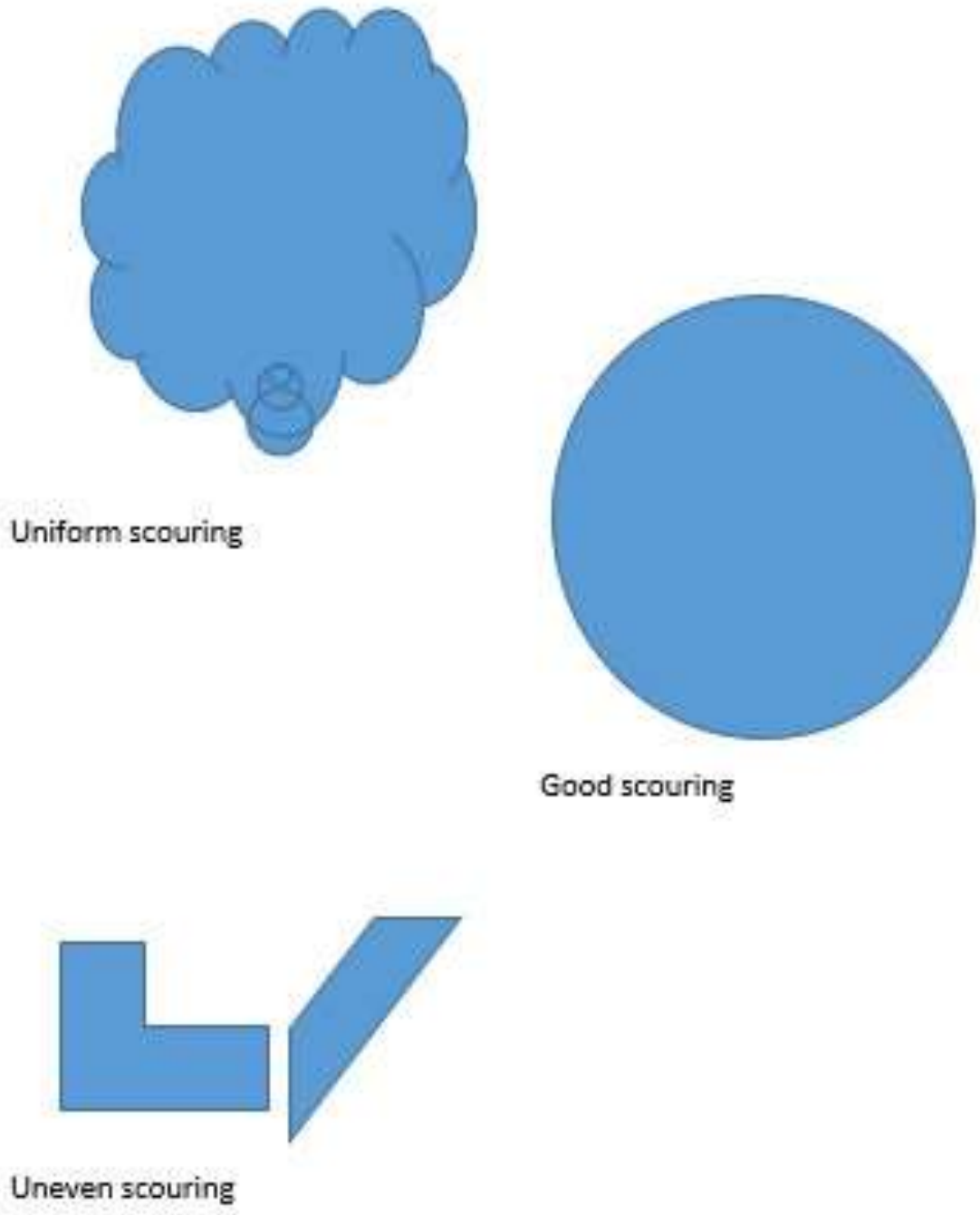


Figure 4.2: Drop Test

4.1.2 Weight Loss %:

To calculate the percentage of weight loss during curing and bleaching processes, you can use the following formula:

Weight Loss Percentage = $\frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}}$ x 100

Before using re-used bath: 45%

After using re-used bath: 37% Where:

Initial Weight: The weight of the material before curing/bleaching.

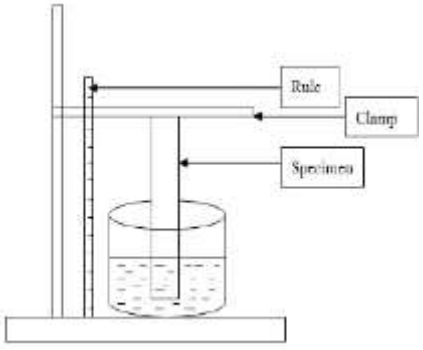
Final Weight: The weight of the material after curing/bleaching.

4.1.3 Wicking test:

The Vertical Wicking test measures how well fabric absorbs and transports moisture. The test dips a pre-marked fabric sample into water or a dyed solution in order measure how well it moves moisture from its source and up and through the fabric.

Good moisture wicking properties can help maintain body temperature when exercising in cold weather as heat transfer from the body to a wet garment is much faster than to a dry garment. The wearer would feel comfortable after the skin temperature cools to a certain level and stops sweating. This ability ensures the absorption and release of moisture to the surface for quick evaporation.

For vertical wicking test, AATCC 197 is one of the standard methods. In this standard, the



bottom of the specimen comes into contact with water. Then, the wicking distance by specified time intervals is recorded. The higher the wicking distance at the same interval, the better the fabric is in wicking.

Figure 4.3: Wicking test

Figure:4.2:wicking test report(Before re-use bath)

Figure:4.2:Wicking test report(After Using re-use bath)

4.2 After Scouring and Bleaching Difference of Physical Properties:

Two crucial steps in the production of textiles are scouring and bleaching, especially when getting materials ready for dyeing or finishing. To get the right properties and look for the cloth, both procedures are essential. Below is an explanation of how they differ in terms of how they affect the physical characteristics of textiles:

Scouring: The purpose of scouring is to eliminate natural impurities from fabric fibers, including oils, waxes, and other pollutants.

Influence on Physical Characteristics

- Purity: By eliminating contaminants, scouring increases the fabric's purity and increases its susceptibility to other processes like dyeing or printing.
- Whiteness: By eliminating impurities or natural colorations, it can improve the fabric's whiteness or brightness.
- Softness: Scouring may occasionally make a cloth feel softer, particularly if there were a lot of contaminants there before the procedure.
- Weight Loss: Because the contaminants are removed by scouring, the cloth may lose a little bit of its weight.
- Bleaching: The goal of the chemical treatment procedure known as bleaching is to further lighten or whiten the cloth, frequently by getting rid of any extra or residual colorants.

4.2.1 Impacts on the Physical Properties:

- Whiteness/Brightness: Bleaching greatly improves the fabric's whiteness or brightness by getting rid of any lingering colors or contaminants from scouring as well as any natural colorations.
- Texture & Handfeel: While scouring may help make a fabric feel softer, bleaching can occasionally have the opposite effect, making a fabric feel harsher or more rigid. This is especially true if the bleaching is done carelessly or if the fabric is exposed to severe bleaching chemicals.

- Weight Loss: Because contaminants and colorants are eliminated during bleaching, it is possible to see a minor decrease in weight, much like with scouring.
- Strength: Fabric strength may be somewhat reduced as a result of chemical treatments, depending on the kind and severity of the bleaching procedure. But this depends on things like the kind of cloth and the bleaching chemicals applied. **4.2.2 Reflating Value by Spectrometer**

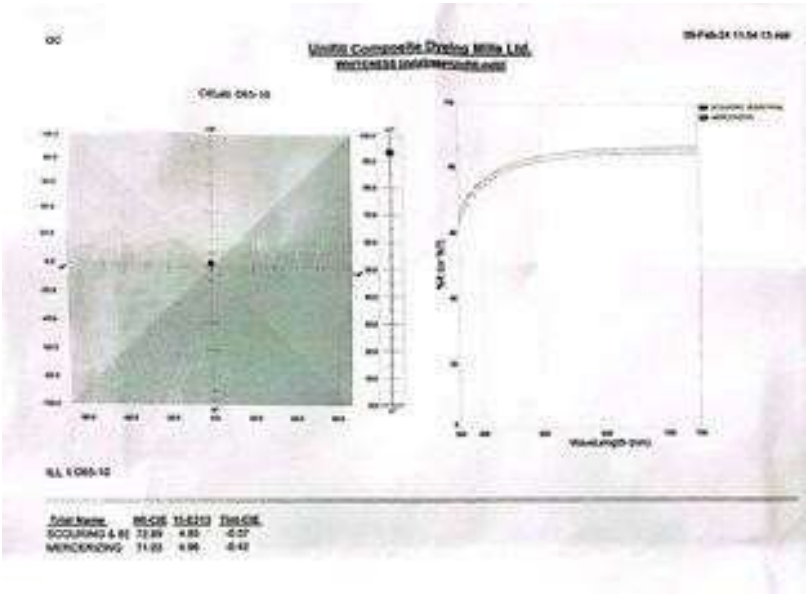


Figure 4.4: Scouring and Bleaching

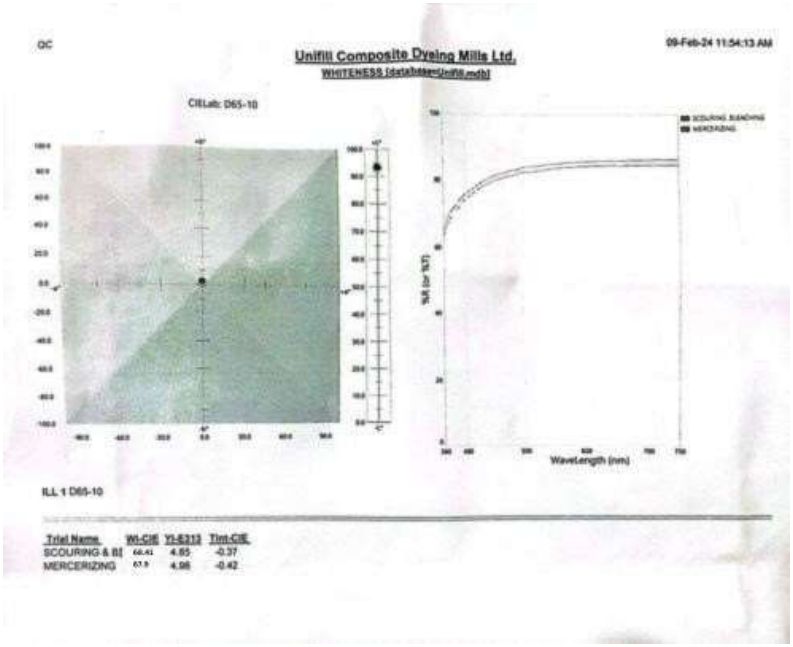


Figure 4.5: Reuse of scouring and bleaching

4.2.3: Immersion Test

Cut a sample 1*1 cm square. Then drop the sample into the 100ml water.

- If in 1sec the sample go under the water then its well scoured.
- If it takes more time to go down then its not well scoured.

In Our test the sample immers in 1.4sec.

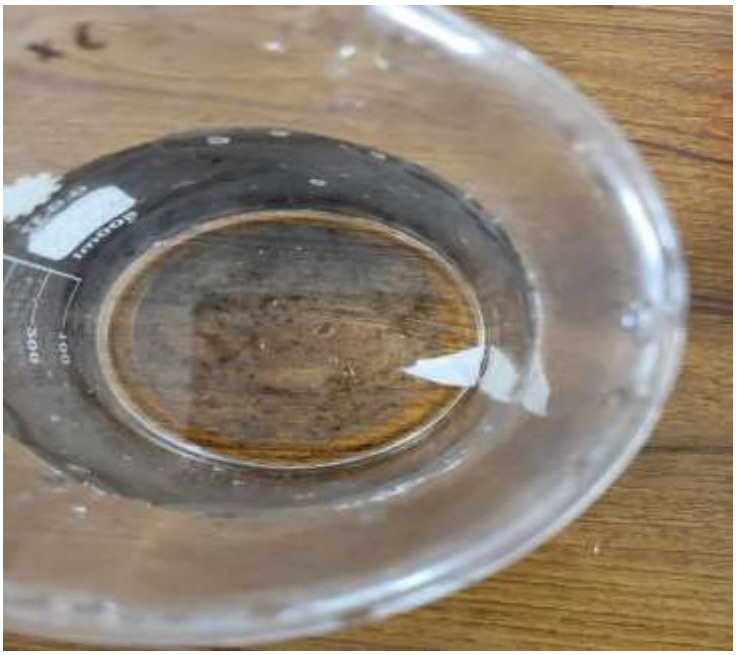


Figure: Immersion Test

CHAPTER-5

CONCLUSION

In conclusion, the experiment detailed the essential processes of scouring and bleaching in textile manufacturing and their effects on fabric properties. Through meticulous experimentation and analysis, several key findings have emerged.

Firstly, the scouring process proved effective in removing natural impurities from fabric fibers, enhancing purity, whiteness, and softness. However, a minor weight loss was observed due to the elimination of contaminants.
Secondly, bleaching significantly improved fabric whiteness and brightness by removing residual colorants and impurities. While it enhanced the fabric's appearance, it occasionally resulted in a slight decrease in fabric softness and texture, depending on the severity of the bleaching process.

Moreover, environmental considerations underscored the importance of adhering to environmental laws and implementing proper waste disposal practices to mitigate the potential hazards posed by textile processing chemicals.

Furthermore, the utilization of automation and sophisticated methods in textile production highlighted the industry's commitment to enhancing efficiency and reducing environmental impact.

Overall, the study provided valuable insights into the scouring and bleaching processes, contributing to the optimization of textile manufacturing practices for improved fabric quality and environmental sustainability.

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