TEXTILE

PRETREATMENT

Akedom

Denge Corporate Academy

TEXTILE PRETREATMENT

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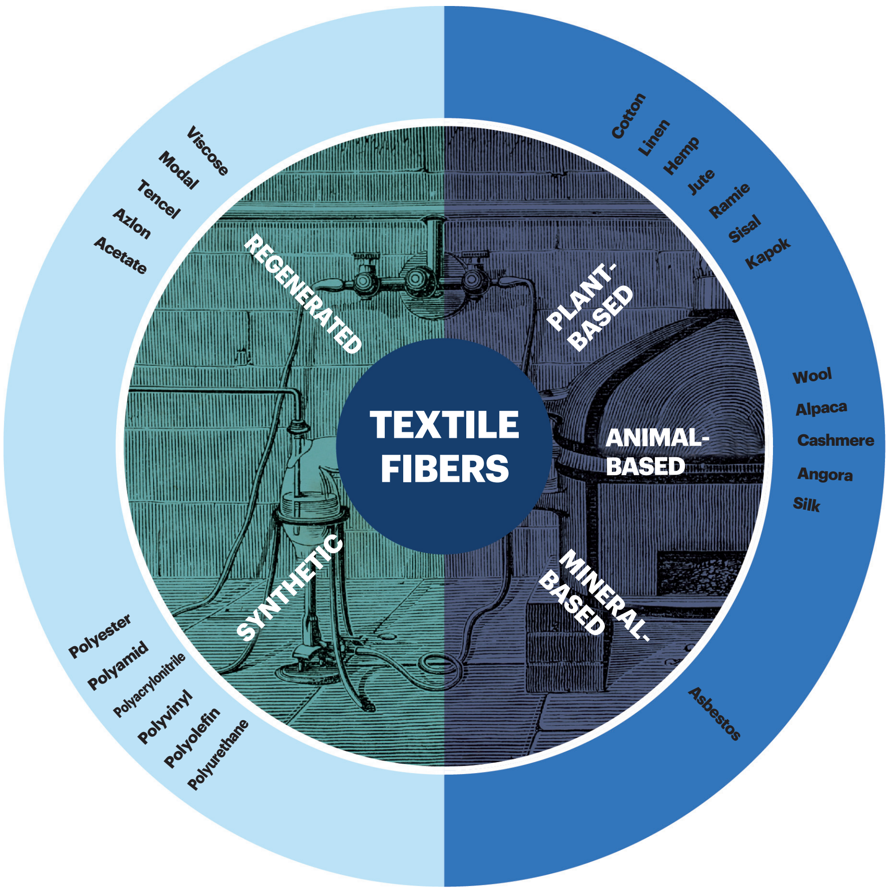
PREFACE

When it comes to pretreatment in the textile industry, it is generally understood as a less important process step before the main processes such as dyeing and printing. This perception or, in other words, misconception has given many process engineers a hard time in the sector and continues to do so.Contrary to this misconception, pre-treatment forms the basis of all subsequent processes, and just like when we button the first button of a shirt wrong, other buttons go wrong, this is exactly the case in textile finishing. Just as before painting a wall, it is necessary to clean the surface from all dust, dirt, rust and to make a preliminary sanding and priming, in textiles, it is necessary to prepare the surface according to the minimum requirements of the next process step. Since the pretreatment processes form the basis for the main processes to be applied later, it is extremely important to show due diligence to make this foundation as solid as possible.As it is known, there are foreign substances such as oil, wax, pectin, dust, soil, proteins on textile fibers. In some cases, warp threads also contain sizing. All these foreign substances deteriorate the appearance of the fibers and give the fibers hydrophobic properties, making it difficult to perform dyeing, printing and finishing processes. Pre-treatment is done to purify the textile material from these unwanted substances and to give the fiber homogeneous, hydrophilicity and whiteness as required. One of the most important parameters at this stage is the quality of the water used. There is no doubt that the quality of the water will significantly affect all of these processes.In addition, the type of machine where the pretreatment processes are carried out, the type of impurities contained in the fibers and the chemicals selected in accordance with them are the most important main factors that will affect the quality of the pretreatment processes. It is a clear fact that deep technical knowledge and experience are needed in making decisions about which process conditions, which recipe and which type of machine the pre-treatment will be done by considering all these effects. In order to develop this knowledge and experience, we found it appropriate to prepare this booklet within Akedom, the corporate university of Denge Kimya.In this booklet, after giving general information about the most commonly used fiber types and structures in the textile industry, we have included various explanations that will contribute to a better understanding of the important types of pretreatment processes used in textile finishing and the distinctive features of chemicals used in pretreatment. In addition, we tried to give detailed information about the types of machines used in pretreatment and the process suggestions suitable for these machine types, as well as various problems and solutions for them.This document, which we think will be especially useful for our sales team and customers and will be an important resource for a better understanding of our products, will be developed over time and will be added to this booklet as innovations emerge.I would like to thank all my colleagues who contributed to the preparation of this booklet and hope that it will contribute to everyone who takes interest in our booklet.

REFİK GÜLBAHAR

1. FIBERS and FIBER TYPES

The textile raw material consisting of fiber or hair structures and suitable for making yarn and fabric is called fiber. Fibers, which are the building blocks of textiles, are classified as natural, regenerated and synthetic fibers according to their source.



2. FIBERS WIDELY USED IN THE TEXTILE INDUSTRY

2.1. Cotton

Cotton still accounts for a quarter of the world's textile fiber production, although its production has declined with the advent of synthetic fibers. With its unique physical and aesthetic properties, it is also biodegradable, making it preferable, although it is produced by more difficult and less sustainable methods than synthetic fibers. High moisture absorbency, good touch and easy processing make cotton the most consumed natural fiber.

Cotton consists of long chains of natural cellulose containing carbon, hydrogen and oxygen, also known as polysaccharides, and its molecular formula is (C6H10O5)n.

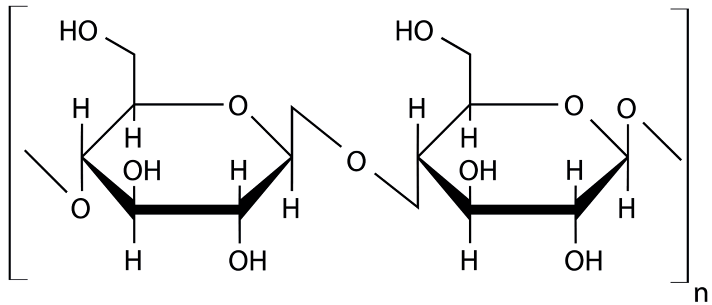


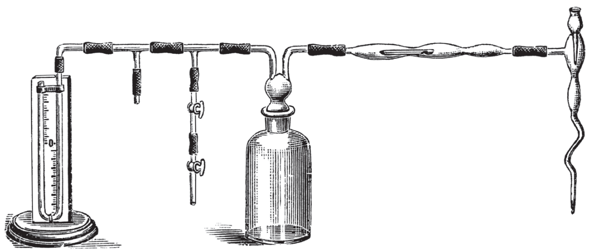
Figure 1: Cellulose chemical structure

Tablo 1: Composition of Greige Cotton Fibers

Composition	Percentage
Cellulosev	80-90%
Oils & Waxes	0,4 - 1,0%
Pectins	0,7 - 1,2%
Proteins	1,0 - 1,8%
Mineral	0,7 - 1,5%
Water	6,0 - 8,0%
Others	0,5 - 1,0%
Degree of polymerization	2000-3000

Tablo 2: Technical Properties of Cotton Fibers

Chemical/Physical Characteristics	Fiber Properties
Acid Resistance	It is damaged by hot dilute or cold concentrated acids and decomposes. 70% concentrated sulfuric acid dissolves cotton fibers. It is not damaged by cold, weak or dilute acids.
Alkali Resistance	It is extremely resistant to alkalis. It swells in sodium hydroxide (such as mercerization) but is not damaged. It can be washed repeatedly in soapy solutions without any damage. Weak alkalis such as sodium carbonate do not affect cotton at low or high temperatures if there is no air in the environment.
Organic Solvents	There are few organic solvents that completely dissolve cotton. It shows high resistance to normal solvents. However, it is dispersed in copper ammonium hydroxide and copper ethylene diamine.
Bleach Resistance	It is resistant to oxidizing agents such as hydrogen peroxide, sodium hypochlorite and sodium perborate, which are widely used in cotton bleaching. Strong oxidative bleaching agents convert cotton into oxy-cellulose.
Heat Resistance	Cotton fibers lose their moisture at 105°C, turn yellow at 115-120°C, become brownish at 180°C, start to char at 185-200°C and completely char at 300°C (i.e. carbonized).

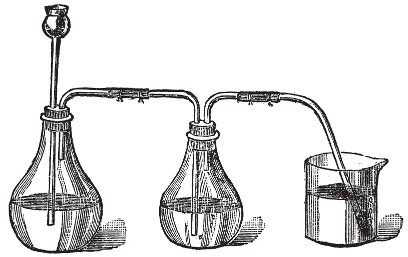


2.2. Viscone Rayon

In the production of regenerated cellulose fibers, cellulose obtained from trees with high cellulose content such as red pine, beech, spruce and poplar is used. The sodium cellulose, which is formed as a result of the treatment of cellulose with lye, is converted into cellulose-xanthogenate by treatment with carbonsulfide. Viscose (viscose rayon) fibers are obtained by spraying the solution obtained by re-dissolving cellulose xanthogenate in dilute caustic through spinnerets into an acid bath. Viscose staple fibers are also obtained by cutting the viscose filament fibers into certain lengths. Although the chemical structure of viscose is highly similar to cotton, its moisture absorption feature is higher than cotton and its surface appearance is brighter. Its dry strength is lower than that of cotton. Its elongation is 15-30%, which is two times higher than cotton.

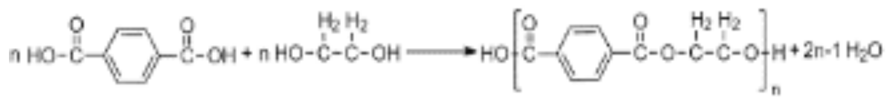
Tablo 3: Technical Properties of Viscose Fibers

Chemical/Physical Characteristics	Fiber Properties
Wet Tenacity	In wet condition, the strength of viscose fiber decreases between 30-50%.
Moisture Absorbtion	There is 10-16% moisture intake. It is more hydrophilic than natural cellulosic fibers. Since their moisture absorption capacity is high, it takes longer to dry.
Acid Resistance	Viscose fibers are damaged by treatment with strong acids. In contact with hot dilute acid, decay is observed on the fibers.
Alkali Resistance	Bases swell viscose. In contact with strong bases, a decrease in the strength of the fibers is observed.
Organic Solvents	Hydrocarbon, chlorine and oxygen-based solvents do not harm viscose.
Oxidizing and Reducing Agents	Viscose fiber is extremely sensitive to oxidizing and reducing agents. They can change color even at low concentrations.



2.3. Polyester

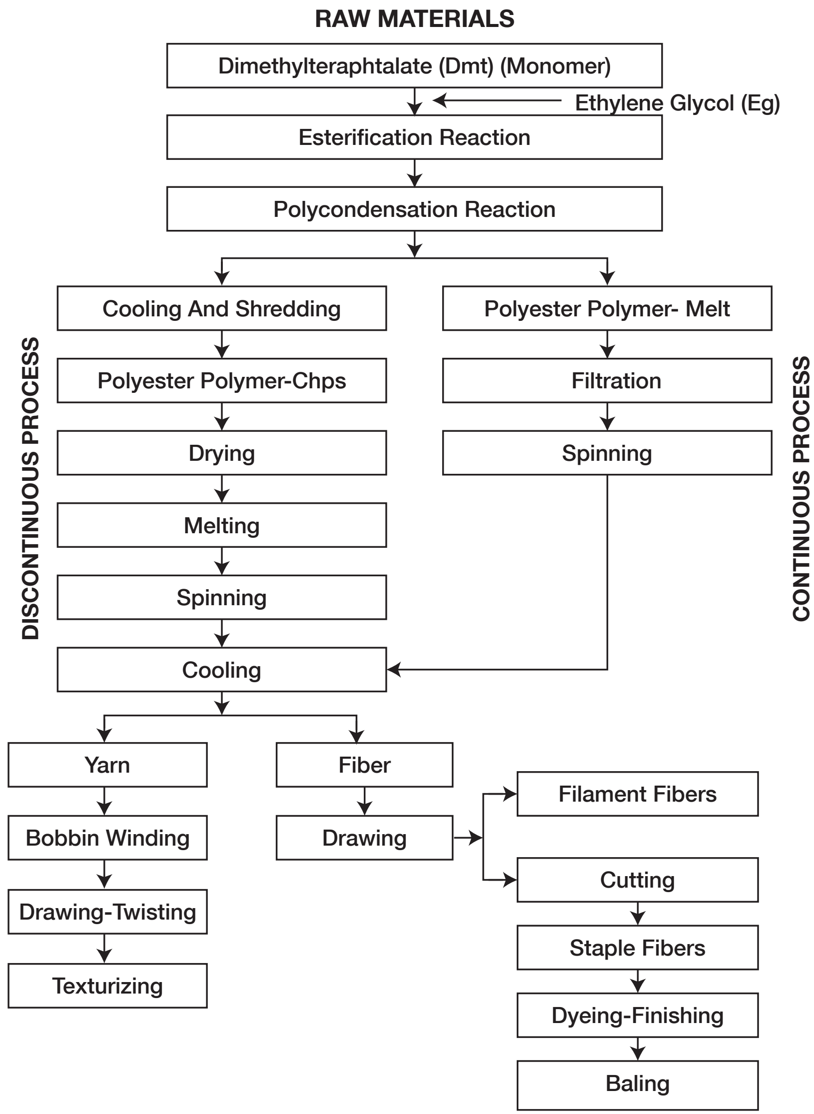
Polyester fibers are the most produced and consumed fibers among all textile fiber types in the world. Such a large amount of use of polyester is due to its easy-to-use properties, durability and compatibility with other fibers. Very low moisture absorbency, sufficient flexibility and good dimensional stability are other features.In fact, the term "polyester" is the name of a fiber class. The class of polymer The melt, which is produced with a discontinuous or continuous system, first takes the form of fibers by passing through spinneret holes with very thin and different cross-sectional shapes, and then solidifies by passing through the cooling section. The yarns formed by combining these fibers are wound on bobbins. The rate of spinning of the fibers from the spinnerets determines containing ester groups in its main chain is called polyester. There are many polymers containing the ester functional group. Polyester fibers, which are generally used in textiles, are formed as a result of the polymerization of terephthalic acid and ethylene glycol. These fibers are called polyethylene terephthalate fibers (PET). Therefore, when PES fibers are mentioned, PET should actually be understood.Polyester fiber production can be done continuously or in discontinuously. In the "continuous" method, the polymer melt obtained as a result of polymerization is fed directly to the spinnerets and fiber spinning is carried out. In the "discontinuous" method, the polymer melt is first solidified and cut into chips, and then remelted and fed to the spinnerets for fiber spinning.The orientation of the polymer chains with respect to each other, and as the rate of spinning increases, the orientation also increases.Yarns produced at speeds where the orientation is insufficient are subjected to a drawing (stretching) process again.After the drawing process, spin finish oils are applied to the PES fibers in order to reduce the fiber/fiber and metal/fiber frictions in the subsequent processes and to prevent the formation of static electricity. The oil ratio on the fiber varies according to the purpose of use. While this rate is 0.2% for fibers to be used in staple fiber production, it rises to 1% for fibers to be used for twisting and texturing processes.



Terephthalic acid   Ethylene glycol   PET

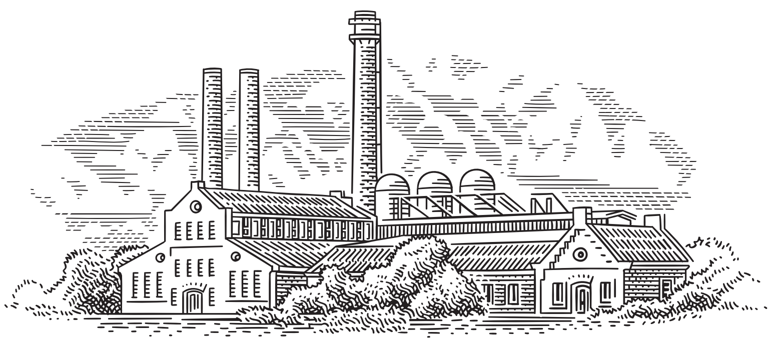
Figure 2: Polymerization of Ethylene Glycol with Terephthalic Acid

Polyester Fiber and Yarn Production



Tablo 4: Technical Properties of Polyester Fibers

Chemical/Physical Characteristics	Fiber Properties
Moisture Absorbtion	%0.4
Abrasion Resistance	It is higher than other synthetic and natural fibers except PA.
Acid Resistance	Resistant to acetic and formic acids. It is resistant to strong acids in the cold, but these acids cause some damage to the fiber with heat.
Alkali Resistance	They are affected by strong alkalis. As the temperature increases in the alkali solution, saponification and dissolution occur on the fiber surface.
Organic Solvents	Polyester fiber has good resistance to solvents used for cleaning and oil removal. They are generally not damaged by organic solvents.
Bleach Resistance	Polyester materials can be safely bleached. Polyesters have sufficient resistance to bleaches such as hydrogen peroxide, sodium hypochlorite and sodium hydrosulfite.



2.4. Polyamide (Nylon)

Polyamide fiber is a synthetic polymer with repeating units linked by amide bonds. Nylon fibers are the first synthetic fibers produced in the world and are also used as a general name for polyamide fibers. Nylon 6.6 and nylon 6 are the most produced polyamide fibers.

Nylon 6.6 (PA 6.6) fibers are obtained by polycondensation of diamine and dibasic acids according to the following reaction.

$$H_2N(CH_2)_6NH_2 + HOOC(CH_2)_4COOH. \longrightarrow H_2N\text{-}(CH_2)_6NH[\text{-}CO\text{-}(CH_2)_4\text{-}CO\text{-}NH\text{-}(CH_2)_6\text{-}]n\text{-}CO\text{-}(CH_2)_4\text{-}COOH$$

Hexamethylenediamine + Adipic acid Polyamide 6.6 polymer

Nylon 6 (PA 6) fibers are formed by the self-condensation of 6-amino-caproic acid or its derivative, caprolactam.

CH2(CH2)4CONH → H2N-(CH2)5-CO[-NH(CH2)5-CO]n-NH(CH2)5-COOH

Caprolactam Polyamide 6 polymer

Tablo 5: Technical Properties of Polyamide Fibers

Chemical/Physical Characteristics	Fiber Properties	
	PA 6.6	**PA 6**
Moisture Absorbtion	4-4,5%	2,8-5%
Acid Resistance	PA 6.6 shows good resistance to weak mineral acids at low temperature. It can be damaged at higher temperatures. It can be damaged by some organic acids (ie formic acid).	It is similar to the behavior of PA 6.6. However, PA 6 dissolves in hydrochloric acid under cold conditions, while PA 6.6 dissolves in hot conditions.
Alkali Resistance	Polyamide fibers have good resistance to alkalis at low temperatures, regardless of concentration. However, they can be damaged at higher temperatures.	
Bleach Resistance	Polyamides can be damaged by oxidants but can be bleached with sodium chloride. Sodium chloride is not harmful to PA fibers.	

2.5. Acrylic and Modacrylic (Polyacrylonitrile)

Acrylic and modacrylic fibers are synthetic fibers manufatured using acrylonitrile monomer and a comonomer. Since acrylonitrile is used as the primary monomer, they are also called Polyacrylonitrile (PAN) fibers. Acrylic fibers are polymers containing at least 85 percent by weight acrylonitrile units; however, modacrylic fibers are those consisting of less than 85 percent and at least 35 percent acrylonitrile units by weight.

Acrylic fibers have features such as being easily washable and keeping their shape, resistant to moth, oil and chemicals, high fastness values, shine and a wool-like handle. Modacrylic fibers are inherently flame retardant and are generally used in technical textiles.

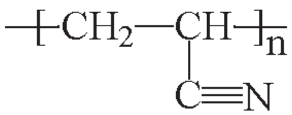
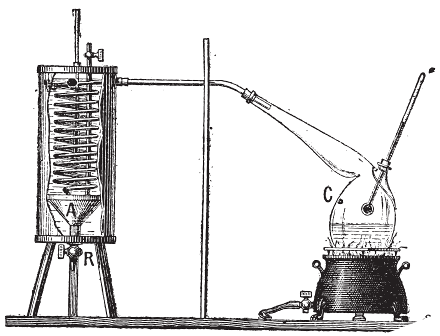


Figure 3: Polyacrylonitrile Formula

Tablo 6: Technical Properties of Acrylic Fibers

Chemical/Physical Characteristics	Fiber Properties
Moisture Absorbtion	1-2,6%
Dimensional Stability	Dimensional stability of acrylic fibers is not good. Steam can cause changes in the dimensions of acrylic products.
Acid Resistance	It is resistant to acids other than nitric acid.
Alkali Resistance	Especially concentrated and hot alkalis damage acrylic fibers.
Bleach Resistance	Resistant to bleaches other than chlorine bleaches.



2.6. Wool

Wool is a protein-based natural fiber that contains amino acids and lipids in its structure. It finds a wide area of use in textiles thanks to its flexibility, crimped structure, good heat retention, soft handle and high moisture absorption properties.

Tablo 7: Components of Raw Wool Fibres

Composition	Percentage
Keratin (Wool Protein)	33%
Dirt	26%
Suint	28%
Grease	12%
Mineral Matter	1%

Tablo 8: Technical Properties of Wool Fibers

Chemical/Physical Characteristics	Fiber Properties
Acid and Alkali Resistance	Very dilute acids and bases do not damage the wool, they only swell the fiber. Normal concentration acids will not harm, but bases can damage the fiber. Especially at very high concentrations bases, and some acids can also hydrolyze wool.
Oxidant and Reductant Resistance	Cystine bonds in the structure of wool can be broken by the effect of reducing agents, but the reaction can be reversed by oxidation. These bonds are irreversibly damaged in the oxidation environment.

Tablo 9: Comparative Some Fiber Properties

Fiber Type	Moisture Regain (%)	Glass Transition Temperature (°C)	Melting Point (°C)
Cotton	13,6-16	-	-
Viscose	10-16	-	-
Wool	0,2-0,8	69-80°C	256°C
Polyester	1-2,6	115°C	230°C
Polyamide	12-14	-	-
Acrylic	4 - 4.5	80-95°C	250°C

PRETREATMENT PROCESSES IN TEXTILE

3. PRETREATMENT OF COTTON

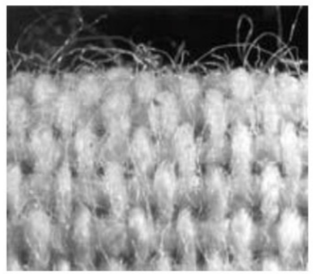
Introduction

Since cotton products contain a wide variety and high amount of natural and manufacturing impurities, they are subjected to numerous pre-treatment processes. In the pretreatment of cotton materials, singeing, desizing, scouring, mercerization, bleaching and optical brightening processes follow each other.

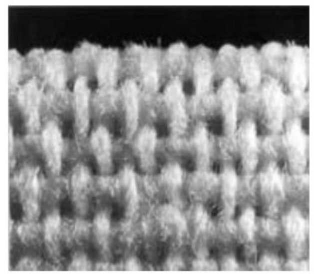
3.1. Singeing Process

The singeing process is the burning of the free fiber ends (piles) that protrude from the yarns in the fabric structure towards the surface. By singeing, brightness on the fabric surface and sharp contours in printing are obtained.

Singeing is usually the first applied process in pretreatment processes. It can be combined with the desizing or bleaching process. Gas and hot plate singeing machines are used for singeing. The burning process can be applied to both fabric and yarn.



Before Singeing



After Singeing

3.1.1. Process Control Parameters in Singeing

- Fabric speed
- Flame intensity
- Singeing (burner) position
- Distance between burner and fabric
- Gas pressure

3.1.2. Singeing (Burner) Positions

A. Tangential Singeing

In this position, the flame from the burners is tangentially contacted with the fabric. Since it is a mild singeing method, it is preferred for singeing sensitive fabrics.

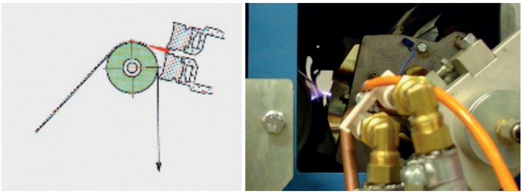


Figure 4: Burner Position in Tangential Singeing

B. Singeing on Roller

In this position, the fabric is burned while passing over the water-cooled cylinder. The flame bounces are contacted perpendicular to the fabric. It is a milder form of singeing than singeing on fabric. This position is preferred for singeing synthetic and synthetic blended fabrics.

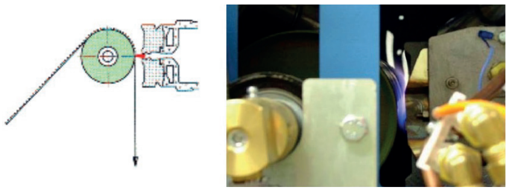


Figure 5: Burner Position in Singeing on Roller

C. Singeing on Fabric

In this position, the back of the fabric is empty and the flame is contacted with the fabric perpendicularly from the burners. It is the strongest form of burning. Therefore, it is applied in the burning of thick and coarse fabrics. This position is preferred for singeing cellulose-based fabrics and synthetic blended thick fabrics.

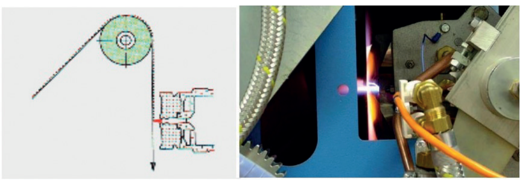
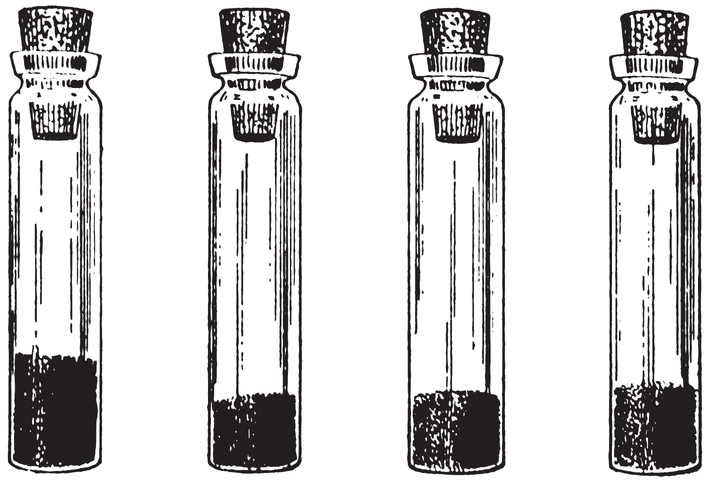


Figure 6: Burner Position in Singeing on Fabric

3.1.3. Points To Be Considered In The Singeing Process

- Singeing causes yellowing, especially in cotton fabrics, but this problem is eliminated with subsequent bleaching process.
- The fabrics to be burned should be completely dry, and there should be no irregular humidity or wetness. Otherwise, the singeing effect on the damp fabric will not be complete or regular.
- It is very important to adjust the flame power, intensity and singeing time in fabrics containing synthetic staple fiber. Insufficient flame power and singeing time and uneven singeing effect can cause pilling of piles, deterioration of fabric appearance and uneven dyeing.
- The temperature of the cooling water after the singeing process of polyester fabrics should be below 40°C. Otherwise, sweating may occur on the fabric and cause singeing stains.
- Care should be taken that the fabric does not become folded or wrinkled while passing through the singeing machine. Since the flame will not touch the floors, a complete singeing process will not take place.
- Fabric tension should be equal all over the fabric
- The dye absorption property of the fabrics changes after the singeing process. During dyeing, cotton and viscose fibers have a lighter color, while polyester fibers are dyed darker.
- In order not to cause loss of elasticity in single jersey knit fabrics containing elastane, burning should not be applied on the back side of the fabric.



3.2. Desizing

Desizing is the first stage of chemical finishing processes. For an effective baking process and therefore for a level dyeing or printing process, the sizing applied to the warp threads before weaving must be properly removed from the fabric.

Sizing of warp threads is done to achieve the following purposes/benefits:

- Eliminating or minimizing warp yarn breaks during weaving
- To add strength, elasticity and lubricity to the yarn
- To prevent static electricity to occur between warp and weft threads
- Adhering the free fibers on the surface of the yarn to the yarn body
- Creating a smooth and flexible film layer on the yarn
- To give the required moisture to the yarn according to its type
- To prevent the yarns from rubbing against each other and pilling during weaving
- Winding the yarns on the weaving beam with optimum and equal tension
- To increase the efficiency of the weaving machine and the quality of the fabric,

Various sizing agents or mixtures are used to achieve these purposes.

Tablo 10: Sizing Agents

Natural Sizing Agents	Synthetic Sizing Agents
Starch	Polyvinyl alcohol (PVA)
Starch Derivatives	Polyacrylates
Cellulose Ethers	Modified Polyesters
Protein	Styrene, polystyrene, Anhydride Copolymer

TEXTILE PRETREATMENT

3.2.1. Natural Sizing Agents

A. Starch Size

Starch size is a polysaccharide composed of glucose units. It is widely used in sizing cotton yarns. The most common methods for removing water-insoluble starch are enzymatic and oxidative desizing methods.

B. Starch Derivative Sizes

1- Oxidized and Acid Modified Starches
2- Starch Ether: Methyl starches, Carboxymethyl starches and Hydroxyethyl starches are in this group. They are generally used for sizing colored yarn.
3- Starch Esters: Used for all yarns. It is especially successfully applied in the sizing of blended yarns (Cotton/PES, PES/Viscose). The size can be removed with enzymes. It is also used for sizing the warps of denim type fabrics where desizing is not required.
4- Pregelatinized Starch: They are starch ethers soluble in cold water. It can be desized with just hot water without using enzymes and is suitable for all kinds of fiber groups.

C. Carboxymethyl Cellulose (CMC) Size

The most important of the cellulose-derived sizing agents is carboxymethyl cellulose size. It is obtained by chemical modification from natural cellulose. It creates a more elastic but lower-strength sizing film than starch. It is suitable for sizing cotton/PES blended yarns.

One of the reasons why CMC is used in sizing is its ability to give the fiber a transparent appearance. It is important in terms of giving pattern clarity to fabrics that will go on sale without dyeing.

D. Protein Based Sizing Agents

There are two main types such as casein (milk protein) and gelatin (protein obtained from animal waste). Today, it is no longer used in textiles.

3.2.2. Synthetic Sizing Agents

A. Polyvinylalcohol (PVA) Size

Polyvinyl alcohol is of great importance in the sizing of staple fiber yarns. Thanks to its strong film forming abilities and good adhesion especially to hydrophobic fibers, it provides the desired productivity during weaving.

Since PVA is a polyhydroxy compound, it dehydrates when exposed to extreme heat. As a result, it becomes insoluble in water. In this case, the hydrophobicity of the PVA remaining on the fabric causes uneven dyeing. For this reason, fabrics sized with PVA should not be burned and exposed to high heat without desizing. PVA is also sensitive to electrolytes and therefore needs to be washed in neutral baths.

B. Polyacrylates

Polyacrylates are used for sizing polyester and other filament yarns as well as staple fiber yarns. The soft and flexible films they form and their high adhesion to fibers provide good results in sizing. Polyacrylates are known as sizing agents that provide the highest weaving efficiency in sizing polyester filaments. Unlike all other sizing agents, polyacrylates are available in liquid form. It is easily removed with water and nonionic surfactants at any temperature.

C. Other Sizing Agents

- Vinyl Acetate Chronic Acid
- Ethyl Acetate / Vinyl Ether Copolymer
- Maleic Acid / Vinyl Ether Copolymer

Almost all of them can be removed from the fabric by washing in alkaline baths with water.

3.2.3. Desizing Methods

A. Enzymatic Desizing of Starch Size

Enzymes are biocatalysts whose chemical structure is protein. The enzymes most commonly used in the desizing of starch size are alpha-amylase enzymes, which only break down starch without damaging the textile fiber. They break the starch quickly and completely, enabling it to become water-soluble components.

Since cationic and anionic wetting agents are harmful to the activity of the enzyme, nonionic rapid wetting agents are used to accelerate the penetration of the enzymatic desizing bath into the raw fabric. Anti-creasing and sequestering agents can also be added to the desizing bath.

Alpha amylase enzymes perform very well over a wide pH and temperature range. The use of substances such as sodium chloride, phosphate acid salts and sugar together with alpha amylase enzymes increases enzyme activity.

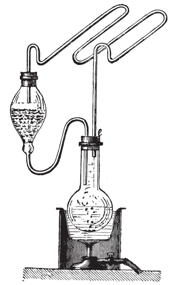
Discontinuous and continuous methods can be applied in enzymatic desizing processes.

a. Cold Pad-Batch Method

After the fabric impregnated in the desizing bath is kept at room temperature for 4-12 hours, it is washed out at 90-95 °C to remove the sizing agent.

Sample Recipe for Cold Pad-Batch Method

4-6 g/L Denglase PRET (0,4-0,6%)	
g/L Denwet ALL Conz New	
pH value	5-5,5
Temperature	50 °C
Wet pick-up	85%
Batching time	6-8 hours



b. Continuous Method

The fabric, which is impregnated with the desizing liquor prepared similar to the recipe given for the Cold Pad-Batch Method is steamed at 105-110 °C for 5-10 minutes and then washed at 80-90 °C.

c. Exhaustion Method

Sample Recipe for Exhaustion Method

0,4-0,6 % Denglase PRET
1.0 g/L Denwet ALL Conz New
pH value 5-5,5
Temperature 80 °C
Duration 20-30 min

B. Oxidative Desizing

Oxidizing agents (ie persulfate, perborate, hydrogen peroxide or chloramine) that can deliver active oxygen to alkaline baths not only oxidize functional groups in starch macromolecules, but also break bridges between glucose rings. Thus, starch breaks down and becomes water-soluble. Soda ash or caustic soda is used to provide alkaline conditions. The most widely used oxidative desizing agent is persulfate.

Sample Recipe for Oxidative Desizing Method

8 g/L Denwet ALL Conz New
5 g/L Denstab HP
15 g/L Persulfate
60-90 g/L Caustic soda (48° Bé)
50-60 g/L Peroxide (%50)
18-24 hours batching at room temperature

C. Desizing Of Synthetic Sizes

All synthetic sizes, waxes, spin finishes, weaving oils and paraffins can be easily removed by washing with a good washing agent at certain pH values and temperatures.

Sample Recipe for Polyacrylate Desizing

1-2 g/L Defaten NOS Conz
1-2 g/L Dng Marine Safe
2 g/L Soda ash
Liquor Ratio : 1:8
Temperature : 80 °C
Duration : 45 min

Tablo 11: Ideal Desizing pH Values for Main Size Types

Size Type	Ideal pH Values
Starch	5-5,5
Modified Starch	7,5-12
Polyacrylate	10-12
PES Size	8-10
PVA and CMC	5-7

3.2.4. Size Tests on Fabric

Before starting the desizing process, it is very important to determine the type of sizing agent on the raw fabric. Thus, it is possible to carry out desizing operations under the right process conditions and to obtain successful results in the shortest possible time. Therefore, it is of great importance to know the type of sizing agent used in terms of production efficiency, product quality, operating costs and time savings.

Tablo 12: Usage Areas of Sizing Agents

Fibers \ Sizes	Starch	CMC	PVA	Polyacrylates	Polyester
Cotton, linen, viscose staple	+	+	+	+	
Wool	+	+	+	+	
Polyester		+	+	+	+
Polyester & Cellulose	+	+	+	+	
Polyester & Wool			+	+	
Polyamide			+	+	
Polyacrylonitrile		+	+	+	
Viscose filament			+	+	

A. Determinaton Of Starch Size

For the determination of starch size, potassium iodide/iodine solution (KI/I indicator) is used. In the Tegewa Scale, the number 1 indicates the presence of size and the number 9 indicates that the size is completely removed. Accordingly, dark blue color indicates the presence of size, while light blue color indicates that the amount of size in the fabric has decreased. The yellow color indicates that the fabric is completely free of sizing.

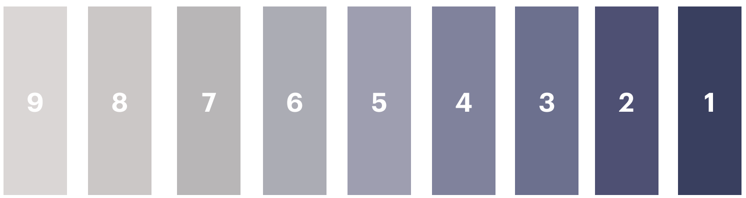


Figure 4: Tegewa Scale

B. Determinaton of PVA Size:

1 drop of chromic acid is dropped onto the fabric and waited for 1-2 minutes. 3 drops of 50% caustic are dropped on it. If the color is brown, it indicates that PVA size is present.

C. Determinaton Of Acrylate and CMC Sizes

The fabric to be tested is boiled for 10-15 minutes with a liquor ratio of 1/40 and the size is transferred to the water. The solution is cooled and 5 drops of 10% copper sulfate are dropped on it. The result is evaluated as follows:

- If the precipitate is clear, there is no CMC and Acrylate size.
- Green precipitate indicates polyacrylate size.
- 3 drops of 80% acetic acid is dropped on the precipitate. If the precipitate is dissolved, CMC size; if it is insoluble or partially soluble or turns white, it is said to be acrylate size.

In order to better understand the desizing processes, the sizes with the highest usage in the sector and their usage areas are given below.

a. Points To Be Considered in Desizing

- It is very important to determine the content of the size on the fabric and to apply the appropriate process for the type of size.
- Undetectable sizes or wrong size determination cause uneven desizing process and hydrophilicity differences on the fabric.
- Differences in hydrophilicity or sizing residues on the fabric cause uneven dyeing or differences in whiteness of the fabric.

3.3. Scouring Process

Grey cotton fabrics contain non-cellulose impurities such as oil, wax, proteins, minerals, natural colorants; vegetable residues such as seed coats, leaves, trashes and additional impurities from manufacturing such as machine grease. Scouring is the process of cleaning these impurities by washing them with detergent (soap) in an alkaline medium. Caustic soda is generally used as alkali.

During the scouring process, all impurities, except the coloring matter, can be removed from the fabric by washing. Waxes and machine oils emulsify in the scouring solution with the help of detergents and alkaline medium. Vegetable residues such as seed coats, leaves, and garbage can swell with the effect of NaOH and can be removed by washing. All these impurities are removed by the washing processes after scouring and the fabrics are made ready for the subsequent finishing processes.

3.3.1. Points To Be Considered in Scouring

- Impurities that are not well emulsified and dispersed in the scouring bath precipitate on the fabric surface and cause staining.
- Fabrics that are not washed properly and effectively after scouring will have uneven hydrophilicity.
- Neutralization of the fabric should be done very well, the pH value on the fabric should be evenly distributed. Otherwise, this will cause uneven dyeing of the fabric.

3.4. Mercerization Process

The purpose of mercerization is to increase the smoothness, brightness, strength and dye uptake ability of cotton yarn or fabric. For mercerization, cotton products are treated under tension with an alkaline solution of 24-30°Be. A more uniform arrangement is formed between the cellulose macromolecules that encounter a strong alkaline solution under tension. At the end of the process, the kidney-shaped cross-section of the cotton fiber swells and becomes round; the surface has a smooth appearance. Thus, the smoothness and surface area of the fibers increase; fibers gain a permanen brighter appearance.

Mercerization increases the dye uptake by 10 - 20%, increases the breaking strength by giving the fiber a natural elasticity and provides dimensional stability.

Mercerization can be done at different finishing stages:

- Mercerization of raw fabric
- After desizing
- After bleaching or between two bleaching steps
- After painting

Mercerization is usually applied before or after bleaching. Since a slight yellowing occurs on the product after mercerization, the products to be used as white must be mercerized before bleaching.

In cotton and polyester blended fabrics, a special mercerization process is applied only to fabrics containing a high percentage of cotton.

Change in cross-section of cotton fiber during mercerization:

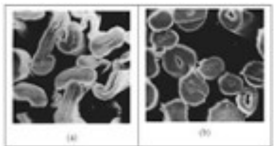


Figure 7:
a: Cross-section of unmercerized cotton
b: Cross-section of mercerized cotton

3.4.1. Mercerization Machines

Mercerizing machines are divided into two groups as chain or chainless type. In both cases, the system consists of an impregnation, a mercerization, a stabilization and a washing zone.

The width and length control of the fabric in chain mercerizing machines is better than in chainless mercerizing machines. However, the space requirements of these machines are higher than those without chains. In chainless mercerizing machines, stretching of the fabric in the direction of its width can be done with the help of tension rollers. The rotational speed of these rollers is increased in a controlled way from the entrance to the exit, so that the fabric is stretched longitudinally. If the rollers are too curved, the tension will increase, but in this case there is a risk of slippage in the warp threads.

Due to the different friction and pulling forces between the edge and middle parts of the fabric on the delivery rollers, higher warp densities may occur at the fabric edges. This may cause colour differences between the edge-middle-edge in dyeing.

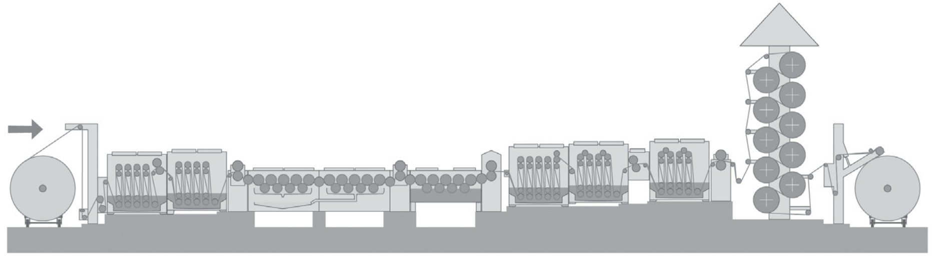


Figure 8: Chainless Mercerizing Machine

Figure 9: Chain Mercerizing Machine

3.4.2. Points To Be Considered In The Mercerization Process

- A serial wetting agent, which is resistant to high alkalinity, ensures proper wetting and has adjustable foam, should be used.
- The fact that the tension of the fabric is less than necessary during mercerization causes the brightness and strength properties of the fabric to be lower than expected.
- The variability of mercerizing conditions (higher temperature and longer treatment time) causes the structure of the cellulose fiber to deteriorate to form oxycellulose and decrease its strength.

3.5. Bleaching

Cotton fibers contain impurities such as cottonseed residues from ginning, leaves, wax, oil, and different natural colored pigments. The presence of these impurities makes it difficult to carry out finishing operations such as dyeing and printing. The colors of yarns and fabrics made of raw fibers generally range from light yellow to gray.

With the bleaching process to be applied to cotton fibers, vegetable impurities, oils and waxes are removed and the fiber is whitened and hydrophilic is achieved. The most widely used method for bleaching cellulosic fibers is the Hydrogen Peroxide method. Sodium Chlorite and Sodium Hypochlorite bleaches are also available, but they have lost their importance in this field today.

3.5.1. Hydrogen Peroxide Bleaching

Hydrogen peroxide (H_2O_2) is a bleaching chemical widely used for bleaching cellulosic fibers. It oxidizes the colored contents on the fiber, causing them to decompose and become colorless. The application of the bleaching process in alkaline baths also provides an advantage in removing the impurities on the cotton fiber.

Hydrogen peroxide performs the bleaching process by activating with the addition of alkali and the effect of increasing temperature. Since the stability of the hydroxyl ion is very weak, it easily decomposes and enables the bleaching process to take place.

Hydrogen peroxide reaction mechanism in bleaching process:

$$H_2O_2 + OH \rightarrow H_2O + HO_2-$$
$$H_2O_2 + 2OH \rightarrow 2H_2O + O_2--$$
$$HO_2- + \text{Organic substance} \rightarrow OH^- + \text{Oxidized organic substance}$$
$$O_2-- + H_2O + \text{Organic substance} \rightarrow 2OH^- + \text{Oxidized organic substance}$$

A. Advantages Of Hydrogen Peroxide Bleaching

- Hydrogen peroxide has a wide usage area. In addition to cotton, it is also used for bleaching fibers such as wool, silk and jute.
- It causes less weight loss in cotton fiber than hypochlorite and gives more hydrophilicity to the fiber.
- Peroxide bleaching requires less water and is safer in terms of bleaching reaction.
- The scouring and bleaching process is done in a single bath.

B. Points To Be Considered in Hydrogen Peroxide Bleaching

The most ideal and safe pH range for hydrogen peroxide bleaching is 10.5 to 10.8. In this range, the rate of formation of the perhydroxyl (HO2-) ion that provides bleaching is equal to the rate of consumption for bleaching. In reactions above pH 10.8, the perhydroxyl ion is released so rapidly that it becomes unstable and oxygen gas is released without bleaching property. This can cause fiber damage. For this reason, stabilizer should be added to the peroxide bleaching bath.

Another important thing to consider during peroxide bleaching is that metal ions cause catalytic decomposition of hydrogen peroxide. Therefore, since the catalytic decomposition of peroxide will be accelerated in process baths containing metal ions, cellulose fibers suffer irreparable damage. In order to prevent this effect, complexing agents that bind metal ions must be present in the bleaching baths.

After bleaching, the presence of peroxide (rest peroxide) on the fabric should be checked and an antiperoxide treatment should be applied. Otherwise, the peroxide remaining on the fabric will cause incorrect dyeing in the subsequent dyeing processes.

4. PRETREATMENT OF VISCOSE FIBRES

Introduction

Viscose fiber is resistant to yellowing up to 125°C. A mild pretreatment is sufficient for viscose fiber. Generally, desizing and bleaching in a weak alkaline bath are sufficient.

Viscose fiber contains residues of sulfur, catalytic metals (especially iron) and oils from fiber production, and sizes in woven fabrics as impurities. Sulfur residues can be removed by oxidation with hydrogen peroxide bleaching, and metallic impurities can be removed with sequestrants used during the bleaching process.

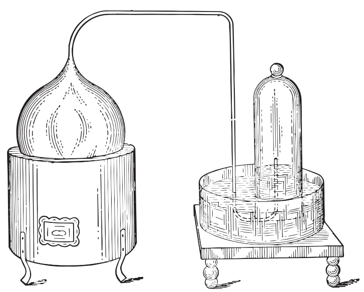
4.1. Desulfurization (Removal of Sulfur Residues)

Although carbon disulphide (CS2), which is used in the production of regenerated cellulose, is removed during fiber production, some amount may remain on the fiber. These residues may damage easily reduced dyestuffs such as reactive dyestuffs in dyeing and printing, resulting in deviations in targeted colors. Therefore, it is necessary to oxidize the sulfur residues on the fiber during pretreatment and prevent it from damaging the next processes.

Sample Recipe For Desulfurization

2-3 g/L Eco Clean
L..R. : 1:10
60 °C , 45 min

Note: This recipe can also be used as a pre-wash recipe for dark dyeing.



4.2. Desizing of Viscose Fabricss

If the sizing agents on the fabric are PVA, CMC and polyacrylate type water-soluble sizing agents, it is possible to remove them with the recipe given below.

In polyacrylate type sizes, the pH value of the desizing bath should be adjusted to pH 11 with an appropriate amount of alkali.

Sample Recipe For Viscose Desizing

1-2 g/L Dng Marine Safe
0,5-1 g/L Denraw NBP
1-2 g/L Soda ash
F.O.: 1:10
80-90°C, 30 min

If viscose fabrics contain starch-based sizing, an enzymatic or oxidative desizing process should be applied.

4.3. Bleaching of Viscose Fabrics

The whiteness of viscose fibers is sufficient for dyeing and printing products. Therefore, bleaching is usually required for products that will only be used in white or dyed in pastel colors.

With a combined hydrogen peroxide bleaching and optical bleaching process in mild conditions, it is possible to both give the product the required whiteness and remove the sulfur residues.

(Note: You can find sample recipes in the Process Recommendations section).

4.4. Points To Be Considered in Viscose Bleaching

- Viscose fibers are not as resistant to alkalis as cotton fibers. For this reason, a milder alkaline soda ash should be used instead of caustic soda.
- Due to its weak wet strength, bleaching should be done quickly and under minimum tension.
- Sulfur residues must be completely removed. Otherwise, especially reactive dyestuffs from the azo class are reduced by sulfur residues and uniform and reproducible dyeing cannot be obtained.

5. PRETREATMENT OF POLYESTER FIBRES

Introduction

Impurities such as preparation agents, antistatic agents, sizing agents, machine oils, marking paints accumulate on polyester fibers until they become a fabric. In order for these impurities not to cause problems during dyeing and other finishing processes, they must be removed by pre-washing. One of the other reasons for prewashing is the removal of oligomers. Oligomers, which are mostly in polyester fibers, rise towards the fiber surface during processes such as heat setting and HT dyeing.

5.1. Prewashing-Desizing of Polyester Fabrics

Desizing and pre-washing processes of polyester fabrics vary according to the production method of the fabric (ie weaving, knitting, etc.).

Polyester and polyacrylate sizes are used for sizing polyester fibers. Pre-washing and desizing processes are generally carried out at 60-80°C in a mildly alkaline environment, using a nonionic/anionic washing agent (detergent) with strong washing and dispersing properties. If working in continuous washing machines, the concentrations should be determined according to the pick-up values and the passing time should not be less than 30-35 seconds.The formation of creases on polyester woven fabrics that are processed as a rope is one of the leading problems. In order to prevent the formation of creases, it should be ensured that the fabric loading amount is made according to the appropriate cycle time, not according to the machine capacity.Considering the weight of the fabric and the elastane content, it is also important that the pretreatment process is carried out under as low tension as possible, the fabric speed is high, the heating and cooling rate is below 2 °C/min.

When polyester and polyacrylate based sizing agents are used together, polyacrylates may cause stain formation on the fabric by reducing the solubility of polyester in the washing bath. This type of desizing should only be done in systems where the washing liquor is constantly renewed(ie by overflowing). In addition, this type of sizing agents can be affected by the hardness of the water. Therefore, soft water should be used or a complexing agent should be added to the wash bath. Polyester knitted fabrics contain various preparation materials (e.g. spin finish, paraffin wax, etc.). For example, 3-6% oil remains on the knitted fabrics during the production. These substances should be removed from the product by washing before the bleaching and dyeing processes.

If the preparation residues are not removed from the knitted products well, they cause a decrease in the sublimation fastness of the disperse dyestuffs in the subsequent finishing processes.

Prewashing-Desizing Recipe for Polyester
2 g/L Dng Marine Safe 1 g/L Defaten NOS Conz 2 g/L Caustic soda/Soda ash (The pH value is adjusted according to the size used) 80 °C, 45 min

Polyester Weight Reduction Recipe
10 g/L NaOH (20 Be) 0,5 g/L Denwet All Conz New, 130 °C, 60 min

5.2. Oligomer Removal

Polyester fibers contain up to 1.5-4% oligomer. The risk of crystallization and collapse of linear chain oligomers on the surface of the fibers and the inner walls of the machine is low. Problematic oligomers are oligomers with a cyclic structure. Oligomers reduce the color brightness, create an uneven dyeing appearance, reduce the efficiency of the machines by collapsing on the pump and heat exchanger in the machines, and leave marks when the product surface is scratched with a sharp-edged object. Therefore, in order to avoid these problems, precautions should be taken before, during or after dyeing.

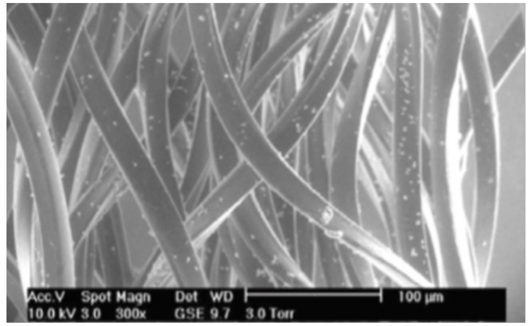


Figure: Oligomer Deposits On Polyester Fiber

5.3. Measures To Prevent the Oligomer Problem

- Dyeing should be done at as low a temperature as possible (125°C and below) and in a short time.
- In order to prevent deposit formation during dyeing, oligomers should be kept dispersed in the bath by adding a dispersing agent along with an oligomer inhibitor (1-2 g/L Denpol OLG).
- Oligomers agglomerate and form deposits during the cooling of the dyeing bath. Therefore, the dyeing bath should be drained as hot as possible.
- At the end of dyeing, an effective reductive washing should be done in alkaline environment.
- The circulation pipes of the machine should be cleaned with an alkaline bath under pressure.
- Dng Marine Safe (1-2 g/L), which has been specially developed to prevent oligomer accumulation in dyeing machines, should be added to prewash recipes.

Machine Cleaning Recipe
3 g/L Dng Marine Safe 3 g/L Dng Clean AR 4-8 g/L Kostik (48°Be) Temperature: 135°C Duration: 60 min

5.4. Whitening of Polyester Fabrics

Generally, a good whiteness of polyester fibers is obtained with an optical brightening treatment. In cases where optical brightening is not sufficient, the fabrics are first bleached with sodium chloride and the stains are removed. After the bleaching process, antichlorination with sodium bisulfite, hot and cold rinsing are performed respectively. After a good washing, high whiteness values are obtained by using an optical brightener with the desired nuance.

5.5. Singeing Process of Polyester Fabrics

Singeing is a process to remove the free fiber ends that protrude from the fabric surface. Therefore, it does not need to be applied to filament yarns. Singeing process can be applied when a lint-free fabric surface is desired in fabrics obtained from staple fibers or their mixtures with natural fibers. Flame length and fabric speed are very important during the singeing process. If the burned parts of the PES fiber form large beads, the color of the fabric will not be uniform as these beads will be dyed darker during dyeing. For this reason, if it is absolutely necessary to burn PES fabrics, it is more appropriate to do it after dyeing.

5.6. Heat-Setting of Polyeter Fabrics

The objectives of the heat-setting process applied to polyester fabrics; to ensure dimensional stability, to prevent wrinkling and creasing, and to prevent edge curling in knitted fabrics.During the dyeing and other finishing processes of polyester fabrics in rope form under HT conditions, shrinkage, wrinkling and permanent creases may occur. In order to avoid such problems, the product must be heat-set before finishing processes. The heat-setting process before dyeing has a significant effect on the dyeability properties of the fiber. As the heat setting temperature increases, dyestuff uptake decreases up to 140-150 oC. When it is between 140-190 °C, the dye uptake is at the lowest level. Therefore, for high dye uptake, heat-setting should be applied at a minimum of 190 °C. However, it is not preferred to perform heat-setting before dyeing unless necessary.With heat-setting process, while the physical properties and dyeability of the fiber change, it also becomes difficult to remove the sizing agents and impurities on the raw fabric. PES fibers have a high affinity for oils. For this reason, it is not recommended to do the fixation before the pre-washing process.

Recommended Heat-Setting Temperatures and Times According to Yarn Type:

Filament Yarns	**: 190-200°C 20-30 sn (on stenter)**
Staple Fibers and Textured Yarns	**: 170-190°C 20-30 sn (on stenter)**
Microfiber Polyester	**: 150-170°C 20-30 sn (on stenter)**

6. PRETREATMENT OF POLYAMIDE FIBERS

Introduction

Polyamide fibers are hydrophobic synthetic fibers. Compared to natural fibers, their tensile strength and abrasion resistance is quite high. While dilute acids generally do not affect the polyamide fibers, hot and concentrated organic acids (formic acid, oxalic acid etc.) cause degradation of the fibers. Their alkali resistance is quite high compared to PES fibers. Sodium chloride and hydrosulfite used in bleaching do not damage polyamide fibers.

6.1. Prewashing-Desizing of Polyamide Fabrics

The success of dyeing and printing processes largely depends on the effective removal of various oils and sizing agents from the product. Warp threads in polyamide woven fabrics are generally sized with polyacrylate-based sizing agents. In some cases, a mixture of PVA or PVA + Polyacrylate is used.

Sample Prewashing-Desizing Recipe for Polyamide

1-2 g/L Defaten Nos conz New
0,5 g/L Denraw NBP
x g/L Soda/Kostik
90-95 °C,
30 min

In cases where PVA size is used, a hot wash should be done without adding alkali. Prewashing can be done with the above recipe for fiber, yarn and knit fabrics that do not contain a sizing agent.

6.2. Heat-Setting of Polyamide Fabrics

The heat-setting process of polyamide fabrics is done for purposes such as dimensional stability, width fixation, and shape stability. It is provided by using one of the steam fixation or hot water fixation techniques. Antioxidant should be used in preheat-setting to prevent decrease in dye uptake and yellowing: 20-30 g/L Denfast FY New

Tablo 13: Recommended Temperature and Times For Pa Heat-Setting

Fiber Type	Heat-Setting Type	Temperature	Time (sn)
PA 6	Hot Air	175 - 190°C	15 - 30
PA 6.6	Hot Air	190 - 215°C	10 - 30
PES	Hot Air	190 - 210°C	10 - 20
PES / PA 6	Hot Air	192 - 195°C	20
PES / PA 6.6	Hot Air	210°C	20

Polyamide woven fabrics can be heat-set before or after dyeing. Knitted fabrics, on the other hand, can be heat-set directly in raw form without the need for washing and relaxation processes.

6.3. Bleaching of Polyamide Fabrics

Polyamide fibers naturally have a good whiteness and generally do not need to be bleached. It is sufficient to apply a treatment with optical brightening agents. However, heat setting can cause yellowing and bleaching can be used to remove it.

6.3.1. Hydrogen Peroxide Bleaching

The use of H2O2 is not recommended for bleaching PA fibres, but it is sometimes used in its blends with It has a great effect on fiber strength loss especially above 50°C.

Sample Recipe For Peroxide Bleaching of PA And PA-Cellulose Blends

1 g/L Denraw NBP
1 g/L Denstab PB OXI
1 g/L Dengolube PC
0,1 g/L Denegol PT
2 g/L Caustic soda (48°Bé)
2 g/L Peroxide (%50)
L.R.: 1:10
Temperature: 85°C, Time: 60 min

6.3.2. Reductive Bleaching

Today, the most common bleaching method in the bleaching of PA products is reduction bleaching. For this, hydrosulfite is used as reducing agent or stable reducing products are used for better reproducible results.

Sample Recipe for Reductive Bleaching

2-4 g/L Dng Clean PN Liq
pH: 4-4,5
L.R.: 1:10
Temperature: 98 °C, Time: 45 min

7. PRETREATMENT OF ACRYLIC FIBERS

Introduction

Prewashing, bleaching, optical brightening and heat-setting processes are applied to acrylic products as pre-treatment processes.

7.1. Prewashing Acrylic Fabrics

Acrylic fibers are very clean fibers like other synthetic fibers. Raw acrylic fabrics contain impurities such as preparation materials, dirt and machine oils, and sizing agents. For this reason, washing is done before dyeing and other finishing processes. Washing can usually be done in acidic pH or slightly alkaline for heavily soiled fabrics. Acetic acid is used for acidic washings, ammonia or soda is used forn slightly alkaline washings. As a washing agent, nonionic detergents in acidic medium and nonionic/anionic detergents in basic medium give good results. Neutralization is required at the end of alkaline washings.

Acidic Wash Sample Recipe	Alkaline Wash Sample Recipe
1-2 g/L Detergent (nonionic)	1-2 g/L Detergent (anionic/nonionic)
1 g/L Acetic acid	1-2 g/L Soda ash or ammonia
50-60°C, 30-35 min	50-60°C, 30-35 min

An important point to be considered in the finishing of acrylic fiber is the drying temperature. Since acrylic material is hydrophobic, it dries easily and even temperatures of 40-60°C are sufficient for drying. Drying at temperatures above 100°C should be avoided. When the temperature is exceeded 80°C, they are easily deformed due to the plasticization of acrylic fiber and the color tone of the dyeing can also change in dyed materials.

7.2. Bleaching of Acrylic Fabrics

Acrylic fibers show yellowness, unlike polyester and polyamide. For this reason, it is important to bleach the acrylic used as white or that will be dyed. Acrylic fiber is the most difficult synthetic fiber to bleach. However, it can be bleached with sodium chloride.

Sample Bleaching Recipe for Acrylic Fabrics

0.5 g/L Denstab HP
0.5 - 1.5 g/L Sodium chloride (80%))
Temperature: 98°C, Time: 30 min

At the end of the process, it is important to cool the bath slowly so that the fabric touch is not damaged.

7.2.1. Combined Bleaching and Optical Brightening Process

Bleaching and optical brightening can be done in one step. In this process, cationic optical brighteners suitable for bleaching and optical brightening are used. In addition to the bleaching agent and auxiliaries, 0.5-2% optical brightener is added to the recipe used. At the end of the process, the bath is slowly cooled. Optical brightener types containing pyrazoline group are not resistant to sodium chloride.

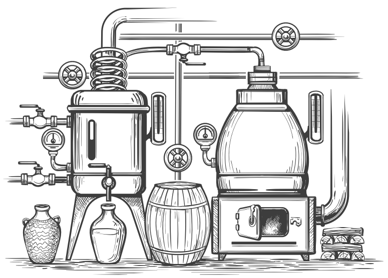
7.3. Heat Setting of Acrylic Fabrics

While the thermosetting effect is permanent in polyester and polyamide fibers, it is lost in heat treatments above the glass transition temperature in acrylic fibers. When the glass transition temperature (80-85°C) of acrylic fiber is exceeded, the fixation effect completely disappears during dyeing as the fibers begin to soften.

Heat setting temperature and time for acrylic fibres

For Acrilan type acrylic fiber, with hot air at 170-180°C, 30-45 seconds
For Courtelle type acrylic fiber, with hot air at 160-170°C, 30-45 seconds
For Polyester/Acrylic blends, with hot air at 190-200°C, 20-30 seconds

Acrylic/polyamide mixtures are heat-set with IR+ steam combination. Pressure steam allows the polyamide part to be shrinkaged without affecting the acrylic part.



8. PRETREATMENT OF WOOL FIBERS

8.1. Washing of Wool Yarns and Fabrics

A good pre-wash is required for the woolen products to be dyed or other finishing processes. Wool threads contain some wool oil, dust, dirt, stain; fabrics may also contain some sizing agent. Washing is carried out mildly at acidic, neutral or slightly basic pH values. An alkaline medium is preferred (with soda or ammonia) for the removal of oils on the fibers.

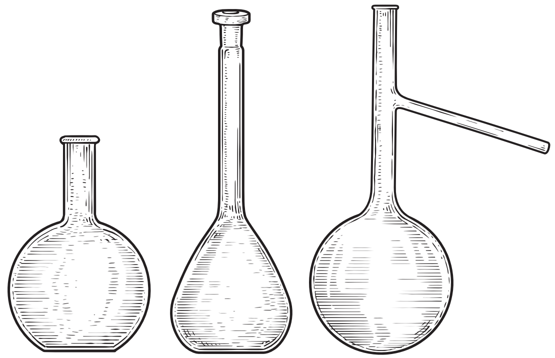
8.2. Bleaching of Wool Fibers

The color of the wool fibers varies from light white to yellow, brown, gray and black, depending on the breed of sheep. Bleaching process is applied for woolen products that will be used as white or dyed light colors.

8.2.1. Reductive Bleaching

Reducing agents such as stabilized hydrosulfite (Blankit etc.), zinc formaldehyde sulfoxylate (Declorine etc.), sodium formaldehyde sulfoxylate (Rongalit etc.) and thiourea dioxide are used for reducing bleaching of woolen products. Thiourea dioxide is more preferred as it causes less damage to wool fibers.

Sample Recipe for Reductive Bleaching of Wool Fibers
1-3 g/L Dng Clean AR 80°C 60 dk



8.2.2. Oxidative Bleaching

Only hydrogen peroxide is effective in bleaching of wool. However, if the bleaching temperature, pH and duration are higher than necessary, it may damage the wool quality and cause a decrease in its whiteness. On the other hand, the control of peroxide stabilization in the bleaching bath is also very important.

Sample Recipe for Oxidative Bleaching of Wool Fibers
0,5-1 g/L Dng Marine Safe
6-8 g/L Denstab PB Oxi
8-15 g/L Peroxide (50%)
pH 9 Amonia (25%)
50°C, 4-5 hours

Since the risk of yellowing of wool fibers is high after peroxide bleaching, neutralization with acetic acid (80%), hot and cold washing should be done after bleaching, and then reducing bleaching should be applied as the second step. The presence of iron and copper ions in the bleaching bath is dangerous. They damage wool fibers due to their catalytic reaction with peroxide.

8.3. Optical Brightening

Optical brightening can be done alone or in combination with the reductive bleaching process. For the combined process, a suitable optical brightener is added to the bath along with the stabilizer and thiourea dioxide, and the process is carried out at 80°C. The pH of the bath is adjusted with acetic acid or formic acid, depending on the characteristics of the optical brightener used. Since wool fibers are easy to turn yellow, protection against yellowing can be achieved by adding hydroxylamine sulfate to the optical brightening bath.

After bleaching or dyeing processes, the following processes are also applied to woolen products, unlike other fibers:

- Fulling
- Fixation
- Crabbing
- Decatizing
- Carbonization
- Anti-felting

TEXTILE PRETREATMENT

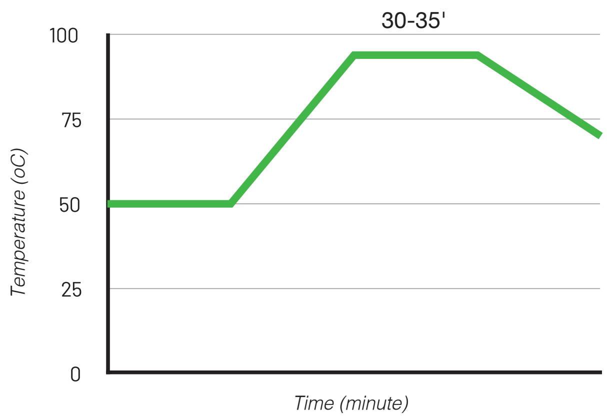
PROCESS AND RECIPE RECOMMENDATIONS

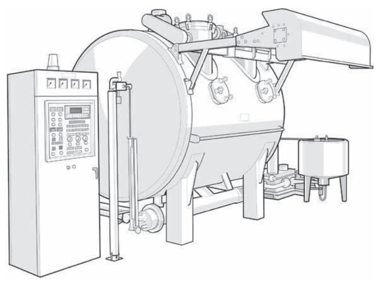
9. PROCESS AND RECIPE RECOMMENDATIONS

9.1. Recipes For Cellulosic Knitted Fabrics

Scouring Recipe

0,5- 1,5 g/L Defaten NOS conz New or Defaten FSP
0,5 - 1 g/L Denraw NBP
2-3 g/L NaOH (48 °Be)
(1 g/L Dengoblue PC) L.R .: 1:10
Temperature: 95-98 °C Time: 35 min



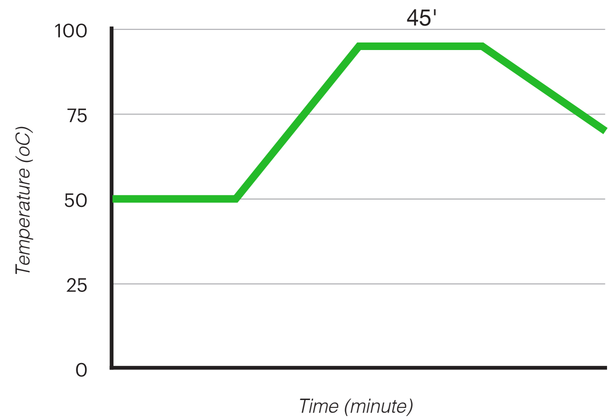


HT Jet Dyeing Machine

Combined Scouring-Bleaching Recipe

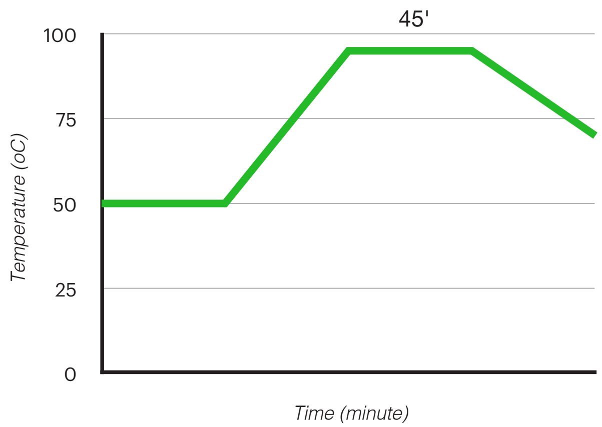
A: 0,5 - 1 g/L Denova Bleach New
1,5 - 2 g/L NaOH (48 °Bé)
(1 g/L Dengoblue PC)

B: 3-7% H_2O_2 (50%)
Temperature: 95-98 °C Time: 45 min



Standard Peroxide Belaching Recipe

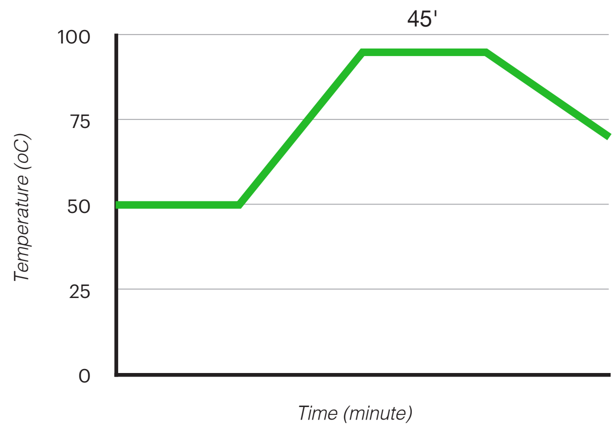
A: 0,5 - 1 g/L Defaten NOS Conz New or Defaten FSP
0,5- 1 g/L Denraw NBP
3 g/L NaoH (48 oBé)
(1 g/L Dengolube PC)
B: % 3 - 7 H_2O_2 (%50)
L.R: 1:10
Temperature: 95-98 °C Time: 45 min or
Temperature: 110 °C Time: 20 min (HT Bleach)



Bleaching Recipe for Turquoise Dyeing

A: 1,0 g/L Denwet BLS
0,5 - 1 g/L Denraw NBP
3 g/L NaoH (48 °Bé)
(1 g/L Dengolube PC)

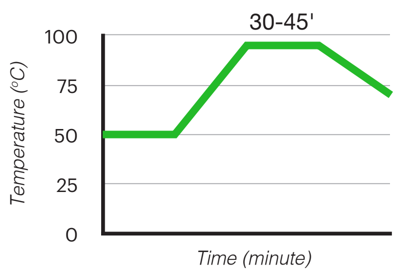
B: 2-4% H2O2 (50%)
L.R: 1:10
Temperature: 95-98 °C Time: 45 min



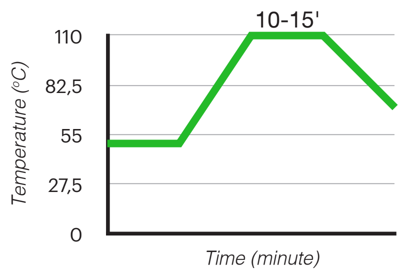
Recipe for High Whiteness and Optical Brightening

A: 1,5 - 2 g/L Dng Marine SAFE New or Dng Marine ONE (Clay Based Wetting agent
0,5 - 1 g/L Denraw NBP
2- 4 g/L NaoH (48 Be)
% 0,3 Denop UW
(1 g/L Dengolube PC)

B: % 6 - 8 H_2O_2 (%50)
L.R: 1:10
Temperature: 95-98 °C Time: 30-45 min or
Temperature: 110 °C Time: 10-15 min



High Whiteness and Optical Brightening Process at 95-98 °C



High Whiteness and Optical Brightening Process at 110°C

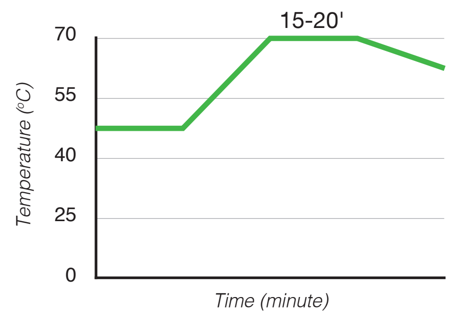
10. PRETREATMENT OF VISCOSE KNIT FABRICS

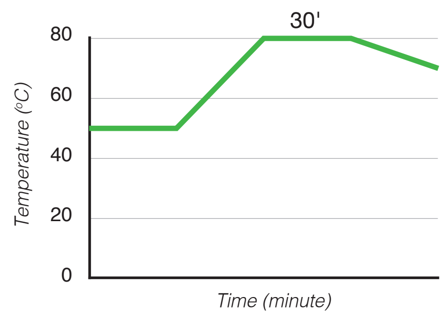
Demineralisation of Viscose Knit Fabrics

1 g/l Denquest DAM
1 g/l Denwest BLS
pH 2.5
L.R: 1:10
Temperature: 70 °C Time: 5-10 min

Peroxide Belaching of Viscose Knit Fabrics

A: 2 - 3 g/L Alp Clean
0,5 - 1 g/L Denraw NBP
0,5 g/L Denstab HP
(1 g/l Dengolube PC)
B: 2-5 % H2O2(%50)
L.R: 1:10
Temperature: 80 °C Time: 30 min

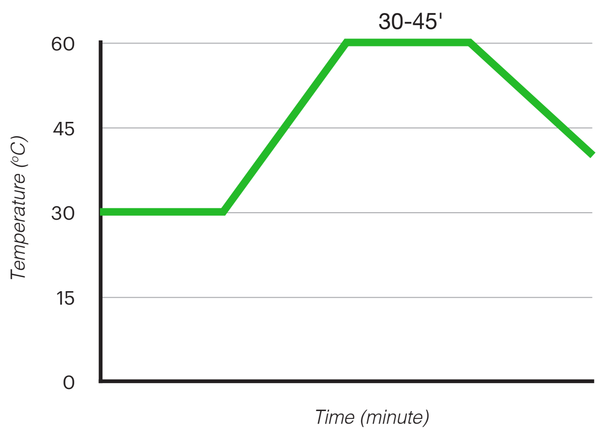




Peroxide Belaching Processes of Viscose Knit Fabrics

Scouring and Sulfur Removal of Viscose Knit Fabrics

A: 2 - 3 g/L Alp Clean
0,5 -1 g/L Denraw NBP
(1 g/l Dengolube PC)
L.R: 1:10
Temperature: 60 °C Time: 30-45 min



11. RECIPES FOR CELLULOSIC WOVEN FABRICS

STEP 1: DESIZING RECIPE

0,5-1,0 g/L Denwet ALL Conz New
0,3-0,5 g/L Denglase Pret
(1 g/l Dengolube PC)
pH 5-5,5 (Acetic acid)
L.R: 1:10
Temperature: 70- 80 °C **Time:** 20 min

2. ADIM: PAMUK DOKUMA KASAR REÇETESİ

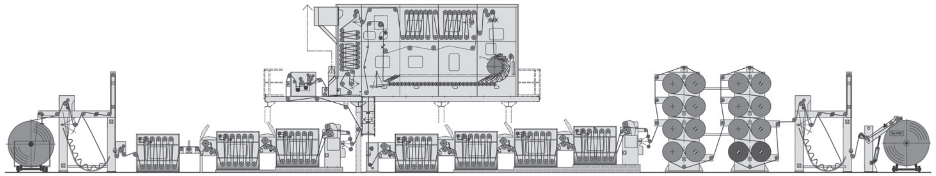
0,5 g/L Denwet ALL CONZ New
0,5-0,8 g/L Denraw NBP
3-4 g/L NaoH (48 oBé)
3-6 % H2O2 (50%)
(1 g/L Dengolube PC)
L.R: 1:10
Temperature: 98 °C **Time**: 45 min or
Temperature: 108 °C **Time**: 10-15 min

ONE STEP DESIZING AND BLEACHING PROCESS

A: 1 - 2 g/L Denwet AFM New (Denova PB Max)
0,5 - 0,8 g/L Denraw NBP
3-4 g/L NaoH (48 °Bé)
(1 g/L Dengolube PC)
b. 3 - 6% H2O2 (50%)
L.R: 1:10
Temperature: 98 °C **Time**: 45 min or
Temperature: 108 °C **Time**: 10-15 min

Thanks to the desizing feature of Denwet AFM New and Denova PB Max, bleaching and desizing operations are performed in one step.

11.2. Continuous Bleaching Process for Cotton Open Width and Tubular Knit Fabrics



11.2.1. Demineralisation

1-2 ml/kg Denwet BLS
ml/kg Denquest DAM
Temperature: 40-60 °C Time: 3-4 min

11.2.2. Washing with Water (60 °C)

11.2.3. Bleaching (Empregnation)

3-5 ml/kg Denwet ALL Conz New
1-2 ml/kg Denquest Conz
5-6 ml/kg Denstab PB Oxi (Denstab HP)
20 ml/kg NaOH (48 oBé)
25 ml/kg H2O2 (50%)

11.2.4. Steaming

Temperature: 102 °C Saturated steam Time: 25min

11.2.5. Washing

Hot and Cold

11.2.6. Antiperoxide Treatment

2 ml/kg Antiper HEC

11.2.7. Neutralization

2 ml/kg Denacid BT New

11.3. Continuous Scouring Process for Woven Cotton Fabrics

11.3.1. Demineralisation

2-4 ml/kg Denwet BLS
2-4 ml/kg Denquest DAM
pH 2,5-3 Sulfuric Acid

Temperature: 30-40 °C Time: 3 min

11.3.2. Scouring Recipe for Non-Sizing Fabrics

ml/L Denwet ALL Conz New
0,5-1 ml/L Denquest Conz-N
60-90 ml/L NaOH (48 °Bé)

Temperature:102 °C Saturated steam Time: 25min

11.3.3. Scouring and Desizing RecipeE

4- 8 ml/L Denwet AFM new (Denwet PB Max, Denwet PBS)
0,5 - 1 ml/L Denquest Conz-N
60-90 ml/L NaOH (48 °Be)

Temperature:102 °C Time: 25min

11.3.4. Steaming

Temperature:102 oC Saturated steam Time: 25min

11.3.5. Washing

Hot and Cold

11.3.6. Antiperoxide Treatment

2 ml/kg Antiper HEC

11.3.7 Neutralization

2 ml/kg Denacid BT New

11.4. One Step Desizing and Bleaching Process for Woven Cotton Fabrics

11.4.1. Demineralisation

1-2 mL/kg Denwet BLS
1-2 mL/kg Denquest DAM

11.4.2. Washing (80 °C)

11.4.3. Bleaching (Empregnation)

4-6 mL/kg Denova PB Max (Denwet AFM, Denwet ALL Conz New)
5-6 mL/kg Denstab PB Oxi (Denstab HP)
1-2 mL/kg Denquest Conz
25-35 mL/kg Caustic soda (48 °Bé)
25-30 mL/kg H. Peroxide (50%)

11.4.4. Steaming

Temperature:102 °C Saturated steam Time: 15-20min

11.4.5. Washing

Hot and Cold

11.4.6. Antiperoxide Treatment

2 ml/kg Antiper HEC

11.4.7. Neutralization

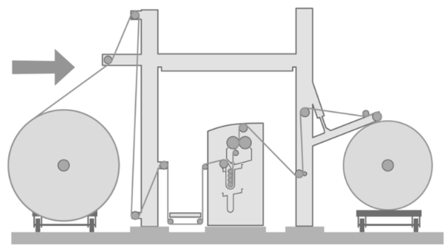
2ml/kg Denacid BT New

11.5. Pad-Batch Desizing and Bleaching Process for Cotton and Viscose Woven Fabrics

11.5.1. Enzymatic Desizing Recipe

3-5 g/L Denglase PRET
2-4 g/L Denwet ALL Conz New

Impregnation temperature: 40-50 °C
Batching temperature: 25-35 °C
Batching time: 4-12 hours



11.5.2. Bleaching Recipe

6-8 g/L Denwet ALL Conz New

5g/L Denstab PB Oxi (Denstab HP)

40-60 g/L H. Peroxide (50%)

60-90 g/L Caustic soda (48 °Bé)

11.5.3. One Step Desizing and Bleaching Process

8 g/L Denwet PB Max

2 g/L Denwet ALL Conz New

5 g/L Denstab PB Oxi

40-60 g/L H. Peroxide (50%)

60-90 g/L Caustic soda (48 °Bé)

Batching time: 16-24 hours

TEXTILE PRETREATMENT CHEMICALS

12. SURFACE ACTIVE AGENTS (SURFACTANTS)

Introduction

The most important chemicals used in textile pretreatment are surface active agents. Substances that lower the surface tension of the environment when dissolved in a solvent are called surface active agents. In short, the chemical structure of these substances, also called surfactants, consists of a hydrocarbon (tail) group and an ionic (head) group. The hydrocarbon group is the hydrophobic (lipophilic) group which is insoluble in water, and the head which can be an acid, alkali or hydroxyl group, is the water-soluble hydrophilic (water-loving) group. Surfactants easily penetrate the surfaces where they are applied thanks to their hydrophilic groups; on the other hand, hydrophobic groups remove substances such as oil and dirt.Because of this feature, surfactants have a wide area of use in industry and household cleaning.

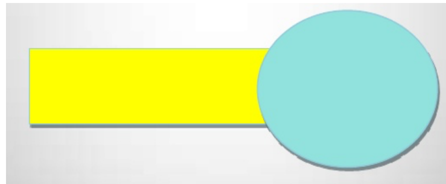


Figure 5: Structure of A Surfactant (Schematic)

$CH_3 - (CH_2)_n$	$CH_2 - SO_3Na$
Lipophilic Group (Soluble in oil)	Hyrophilic Group (Soluble in water)

Surface tension is the force per unit length that opposes the surface expansion of liquids. For example, for water; a force of 72.8 dyn is needed to break the intermolecular interactions on the liquid surface for 1 cm. In other words, the surface tension force of water is 72.8 dyn/cm.

Cohesion: The force of attraction between the molecules of the liquid
Adhesion: The force of attraction between the liquid and the solid

12.1. Hydrophilic-Lipophilic Balance (HLB)

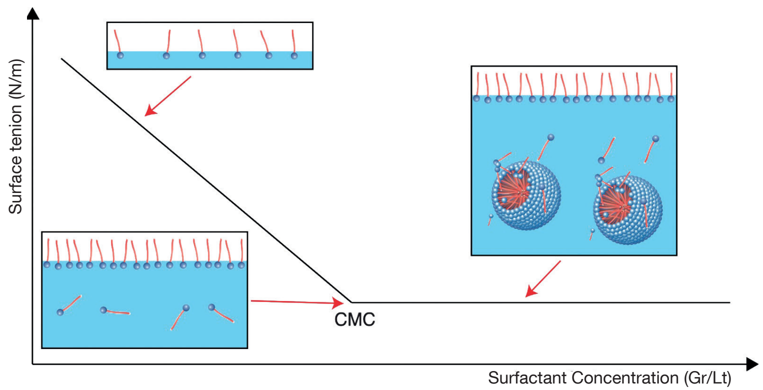
The HLB value of a surfactant refers to the weight balance between hydrophilic and hydrophobic groups in the molecule. TThis value is expressed as the value obtained by dividing the mole percent of the hydrophilic group in the molecule by five. It is rated from zero to 20. Low values indicate that the molecule has lipophilic character, closer to 20 the hydrophilic feature increases.

12.2. Critical Micelle Concentration

All surfactants exhibit typical colloidal electrolyte properties in their aqueous solutions. That is, they form more or less regular, usually electrically charged clusters of molecules known as "micelle" in solution. Pure water has a surface tension of 72.8 dyn/cm. When a certain surfactant is added to this water slowly, the surface tension of the water begins to drop rapidly. However, after the surfactant reaches a certain concentration in water, the surface tension does not decrease further and becomes stable even if the addition of surfactant is continued. This concentration at which the surface tension curve begins to flatten is called the critical micelle concentration (CMC) of that surfactant. From the graph below, the variation of surface tension versus concentration can be seen.

After the critical micelle concentration, the surfactant molecules aggregate into clusters in solution. Surfactant micelles are spherical or layered as shown in the figure.

The critical micelle concentration is usually very low, and up to this concentration the molecules organize themselves only at the solution-air interface. This is the effect that lowers the surface tension. However, when the critical micelle concentration is reached, the interface becomes saturated and as the concentration increases, micelle clusters begin to form in the solution. At concentrations above the critical micelle concentration, the surface tension does not decrease any more and wetting etc. surface-active properties no longer change.



12.3. Cloud Point

When nonionic surfactants are in water, the hydrophilic parts are surrounded by water molecules and dissolution occurs. With the increase in temperature, this system is disrupted and the surfactant becomes insoluble in water and is released in the environment. As a result, the surfactant cannot perform its function effectively, and the solution becomes cloudy. Wetting abilities of nonionic surfactants increase with increasing temperature up to cloud point (maximum effect is reached just below cloud point). However, after the cloud point is exceeded, its wetting ability weakens (insolubility of the surfactant).

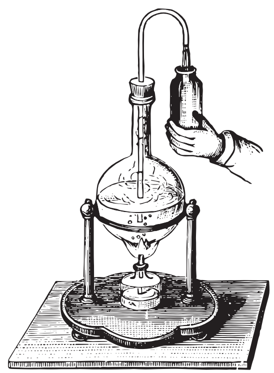
12.4. Classification of Surfactants

Surfactants are classified according to the structure of the hydrophilic group as follows:

1. Anionic Surfactants
2. Cationic Surfactants
3. Nonionic Surfactants
4. Amphoteric Surfactants

12.4.1. Anionic Surfactants

It consists of one or two hydrophilic groups attached to a lipophilic (hydrophobic) group. The hydrophilic functional group is anionic. Such as **$-OSO_3^-$, $-SO_3^-$, $-COO^-$** groups.The simplest example is soap. Anionic detergents are sodium salts of organic sulfates or sulfonates.



12.4.2. Cationic Surfactants

It contains a lipophilic hydrocarbon group and one or more hydrophilic groups. The hydrophilic functional group is cationic. Such as –(CH3)3N+, C2H5N+ groups.It has very good softening and antibacterial properties. They are used as a softener in textiles and laundry. Fatty acid amine condensation salts show the general structure of cationic softeners.

$R – C_2H_5N+$

Quaternary Ammonium salts, called weak cationic or pseudo-cationic, belong to the class of cationic surfactants. For example, Lauryl trimethyl ammonium chloride:

$C_{12}H_{25}N(CH_3)_3\,Cl$ ...... $N^+(CH_3)_3-$

(hydrophilic group)

In cationic surfactants, the hydrophilic group is positively charged. Since cellulose molecules are generally negatively charged in aqueous environments, it is a good softener and lubricant in textiles. Washing feature is not good. It is a paint remover for anionic dyestuffs.For example, maleic acid quaternary ammonium salts are used in cosmetics as emulsifiers and stabilizers in creams. Quaternary ammonium copolymers are also used as germicides. The use of cetyl stearyl trimethyl ammonium chloride or its sulfate salts as domestic fabric softener has gained great importance. Since the negative charges on the surface of the laundry are removed by the positive charge of the softener, it also acts as an antistatic.

12.4.3. Nonionic Surfactants

These substances are soluble in water but do not give ions, so the substances in this group are called nonionic surfactants. The water-soluble portion contains a polyoxyethylene chain and hydroxyl groups. The ability of a nonionic surfactant to form a hydroxyl group with water, ie the hydroxyl number, determines the hydrophilicity of the surfactant. While those with ethoxylated alcohol degree up to 12 show wetting properties; the ones with higher than 12 have better washing property. Therefore, the degree of EO should be taken into account in the selection and use of nonionic surfactants in textile processing steps. Nonionic surfactants are obtained by adding more than one ethylene oxide (sometimes propylene oxide) to a long chain alcohol molecule. Polyethylene oxide group (and polypropylene group), that is, ethoxylate (and propoxylate) groups are hydrophilic groups.

12.4.4. Amphoteric Surfactants

Amphoteric surfactants give both positively and negatively charged ions when dissolved in water. That is, hydrophilic groups have both positive and negative charges. In other words, the hydrophilic group of Amphoteric Surfactants contains both cationic and anionic groups. For example, such as Alkyl Betaines. General formula:

$R–N(CH_3)_2(CH)_2COO$

Here, N is positively charged and COO is negatively charged. The feature of this group is that it can give both anionic and cationic reactions depending on the type of ion present in the water. They are not effective as washing agents, but they show very good antibacterial properties.

They also have emulsifying and softening properties. Their use is not very common. Amphoterics have a small proportion in the total surfactant usage rate. Amphoteric surfactants are compatible with anionic and cationic substances. They can be used at all pH values. Although this seems to be an advantage, care should be taken in terms of anionic-cationic reaction that may occur in use.Anionic surfactants are effective at pH 8 and above, and cationics at pH 5 and below. It should be noted that amphoteric surfactants can react with cationic substances below pH 7 and with anionics above pH 7.

12.5. Wetting Agents

Wetting chemicals are surfactants. Cellulose fibers with hydrophobic impurities such as oil and wax are very difficult to get wet and therefore cannot absorb water in a short time.

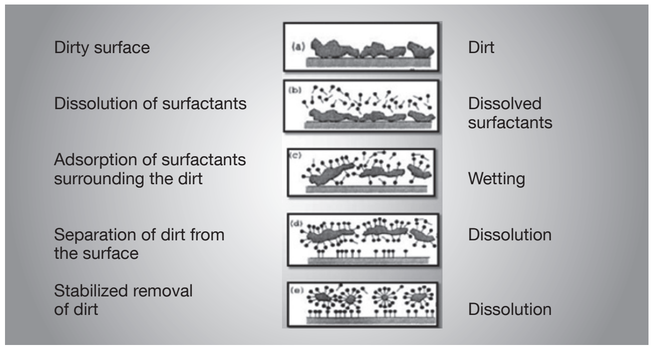
The wetting agent allows water to penetrate the cellulose fiber quickly and evenly. When choosing a wetting agent, it is preferred that provides fast and uniform wetting. However, it is also important that it is resistant to alkaline environment depending on the type of process.The most critical feature of nonionic wetting agents is that they are sensitive to temperature. With the increase in temperature, the dissolution of nonionic wetting agents changes inversely. Nonionic wetting agents have the best wetting power at the point just below the point where the solubility increase stops. If the temperature at the saturation point of the solubility is exceeded at a suitable stage, the wetting agents that become insoluble in water remain on the fabric. This will improve the absorbency and rewetability of the product, and above this temperature, foam formation is minimal since the wetting agent is insoluble. Nonionic wetting agents, which have good emulsifier properties for oils and waxes on the product, also have good washing properties.

12.6. Dealrating Agents

Air-removing chemicals are surface-active materials. They are chemicals used especially in the pretreatment of tightly wound yarn bobbins or tightly woven fabrics. Thanks to their excellent penetration properties, these chemicals allow the liquor to penetrate the bobbin or fabric quickly.

12.7. Oil/Grease Removers

Degreasing (Oil-removing) chemicals are usually anionic or nonionic surfactants. The cross-linking reaction of the oils on the textile product is accelerated by being catalyzed by the metals in the environment. These metals can be found in the form of metal dusts from transport trolleys, weaving reeds, etc. due to abrasion, or metal salts on raw fabric. It is ensured that these oils on the fabric are removed with oil-removing chemicals.The mechanism of cleaning the oil from the fabric is as follows:



12.8. Sequestering Agents

Sequestering (complexing, chelating) chemicals are substances that render hard water ions and heavy metal ions harmless. They prevent fiber damage and deterioration of bath stability by forming complexes with calcium, magnesium and iron ions in water. Calcium and magnesium ions in hard water form water-insoluble complexes. This situation especially reduces the effectiveness of anionic surfactants and the precipitation of water-insoluble complex compounds on the textile product causes problems in the subsequent coloring processes. The presence of iron ions during bleaching processes is very dangerous.

It accelerates the uncontrolled breakdown of hydrogen peroxide. Hydrogen peroxide, which is broken down by the action of these metal ions, causes staining and damage on the fiber. In coloring processes, metal ions and dyestuff molecules may react and cause precipitation, discoloration, uneven dyeing and decrease in fastness properties.Metal ions are usually found in process waters. Apart from that, some metal ions may dissolve from the machine surface.Such metals may also be present on the textile material, or some dyestuffs and chemicals used may contain metal ions. For this reason, it is not possible to prevent these problems by only using soft water in the processes.To prevent all these problems, some chemicals that only react with metal ions are used. These substances are ion scavengers (sequestrants).

Sequestering agents work by complex (chelate) formation mechanism. Thanks to the complex structure they form with the metal ion, it is prevented that the metal ion reacts with other chemicals in the environment and precipitates on the fabric.Catalytic Decomposition of Hydrogen Peroxide:

$$Me + H_2O_2 \rightarrow Me^{++} + OH- + {}^{\bullet}OH$$

These OH radicals, which are formed as a result of the catalytic effect can cause hole formation by damaging the fabric.Sequestrants are generally divided into two groups as Polyacrylate and Phosphonate derivatives according to their common usage:

- Sequestrants in polyacrylate structure have a high effect on calcium binding capacity.
- Phosphonate derivative sequestrants have a high effect on iron binding capacity.

12.9. Stabilizers

The addition of stabilizer to the process bath in peroxide bleaching processes slows the release of atomic oxygen, which acts as the active bleaching agent. The formation of molecular oxygen, which has no bleaching effect and emitted into the atmosphere, is controlled.In the past, sodium silicate was a widely used stabilizer in peroxide bleaching. But today, organic stabilizers have replaced sodium silicate. Because, when sodium silicate reacts with magnesium salt, insoluble solid magnesium silicate is formed. This precipitates on the cotton product and on the machine. Accumulated residues cause difficulties in dyeing processes and cause hardening of the handle of the cotton product.

12.10. Anti-Creasing Agents

Anti-crease chemicals minimize friction by creating an air cushion between the fabric and the machine, especially during the processing of cellulosic fabrics such as cotton, linen and rayon. It also gives the fabric slipperiness and softness. Due to its slippery feature, it prevents the formation of crease on the fabrics.It is recommended to add anti-creasing agent to the process bath before the fabric during use. It does not cause any problem when used in dyeing. With polymer-based anti-creasing agent there is no precipitation problem in dyeing processes.

12.11. Acid Buffers

Buffer solutions are aqueous systems that resist changes in pH when a small amount of acid or base is added. They consist of a weak acid (proton donor) and its conjugate base (proton acceptor). Buffering results from the equilibrium reaction between a proton donor (HA) and its conjugated proton acceptor (A-) in a solution.When H+ or OH- is added to a buffer, the result is a small change in the ratio of the relative concentrations of the weak acid and its anion, and thus a small change in pH.A decrease in the concentration of one component of the system is completely offset by an increase in another.The sum of the buffer components does not change, only their proportions. In solutions where pH adjustment is made with buffer chemicals, pH change is reduced to a minimum during the process. It is especially preferred in processes where the activity of chemicals such as enzymes are directly affected by the pH change of the environment.

12.12. Enzymes

The main enzymes commonly used in textile processes are desizing, biopolishing and antiperoxide enzymes.

12.12.1. Desizing Enzyme-Alfa Amylase Enzyme

The surface of the warp threads used in the weaving of cotton and cotton blended fabrics is covered with sizing agents. The main purpose of this is to prevent the threads from breaking during weaving. The sizing agents commonly used for this process are starch and starch derivatives. However, after the weaving process is finished, the starch on the fabric must be removed before proceeding with the subsequent finishing processes. Alpha amylase enzymes are used to remove starch on the fabric.

12.12.2. Biopolishing Enzyme - Cellulase Enzyme

Biopolishing with cellulase enzyme is an enzymatic process for cleaning the free fibers protruding from the surface of cotton fabrics and yarns. Effects provided by the biopolishing process; a clean surface with lower hairiness, reduced tendency to pilling, better handle, and a unique softness when combined with commercial softeners.

12.12.3. Antiperoxide Enzyme - Catalase Enzyme

It is used to remove the peroxide remaining on the product after peroxide bleaching. It is an enzyme that breaks down hydrogen peroxide into water and oxygen.

Optimum working conditions are applied as 45-50 °C and pH 4.5-5.

$$H_2O_2 \xrightarrow{\text{Catalase}} H_2O + \frac{1}{2} O_2$$

12.13. Powder Alkaline Bleaching Agents

Powder alkaline bleaching chemicals are products used in the pretreatment of viscose fiber. In the pre-treatment of viscose products, besides providing whiteness, it is also aimed to remove the sulfur from the fiber production stage. Removal of sulfur on viscose is very important for proper dyeing.Since viscose fibers are not resistant to strong alkaline environment, soda is used instead of caustic in bleaching processes. At the end of the bleaching process, neutralization is done with acid.Powder bleaching agents are used in viscose bleaching as a combined chemical since they also create hydrogen peroxide by raising the pH of the bath when dissolved in water.

13. PROBLEMS IN TEXTILE PRETREATMENT AND THEIR SOLUTIONS

13.1. White Stains on Dark Colored Fabrics

Calcium and magnesium ions from cotton fiber, water and plumbing are likely to combine with soap produced during alkaline pretreatment to form lime soap. This lime soap formed precipitates on the fabric and inside the machine. As the precipitates on the fabric prevent dye uptake during dyeing, white spots occur in the precipitated areas. The way to avoid this problem is to add an effective sequestering agent to the bath.

13.2. Low Whiteness, Strength Loss and Hole Problems in Cellulosic Products

The presence of iron, copper and manganese in peroxide bleaching bath causes uncontrolled catalytic decomposition of hydrogen peroxide. As a result, it causes loss of strength, hole problems and low whiteness degrees in cellulosic fabrics. In order to eliminate these problems, the complexing agent to be used should not only have a high Fe ion holding capacity, but also hold alkaline earth metals and have dispersion properties.

13.3. Low Hydrophility Problem on Fabrics

The low hydrophilicity of pre-treated fabrics causes color differences between head-end and side-center-side, especially in pad-batch dyeing.For this reason, products with good wetting and washing properties as well as good emulsifying-dispersing properties should be used for alkaline pretreatment. Afterwards, a very good washing and neutralization should be done. Water quality and conditioning are very important in the textile industry. For a successful pretreatment process, the bicarbonate, hardness, pH and Fe^{+2}, Si, Cl- ion values of the water used should also be checked. Daily control and monitoring of the softness of the process water must be done.

13.4. D. Head-End Color Difference

The head-end difference problem is the color difference that occurs between the beginning and the end of a fabric lot dyed by the impregnation (padding) method. It is also known as the tailing problem. One of the most important reasons for the head-end difference is the whiteness and/or hydrophility differences that may occur between the beginning and the end of the fabrics in pretreatment.

13.5. E. Side To Side Color Difference

It is the color difference between the right, middle and left parts of dyed fabrics. One of the reasons for this error is the change in hydrophilicity across the width of the fabric due to improper pretreatment processes.

13.6. F. Molten Beads

During the singeing process, synthetic fibers such as polyester may melt and solidify and form beads on the fabric surface. Since the dye affinity of these beads is higher than the rest of fibers, they take more dye during dyeing and cause a specky, irregular appearance on the fabric surface. In these cases, it is recommended to perform the singeing process after dyeing.

13.7. Catalytic Damage

Especially during bleaching of cellulosic fibers with hydrogen peroxide, heavy metals such as iron and manganese in the environment decompose very quickly by catalyzing the degradation of peroxide. As a result, there is a loss of strength in the fabrics or damages in the form of holes as small as a pin head (pinholes).Iron and manganese may come from the process water, the chemicals used or the textile material. The extent of the damage is dependent on the amounts of these metals.Using a sequestering agent in the processes keeps the small amount of iron and manganese ions in the form of ions and prevents the fabric from being damaged. However, the most effective solution for metal residues in the form of metal dust (rust stain, etc.) is to perform a demineralization process before bleaching.If these metal residues are detected in the process water, it should be considered that it may be from the source of the water or that it may have passed into the water from old installations and machinery parts. The presence of these metal residues on the textile material means that there is a problem in the processes before the dyehouse. Necessary controls, maintenance and repairs should be made in the yarn, weaving or knitting departments.

13.8. Yellowing

The fabric may turn yellow due to the use of unsuitable optical brightener during the pretreatment processes, the use of high concentration optical brightener, or the absence of antichlorination after hypochlorite bleaching.

DNG PRODUCTS

14. DNG PRODUCTS
14.1. Wetting Agents

DENWET ALL CONZ NEW

Nonionic concentrated wetting agent with very good wetting, hydrophilic, degreasing and washing properties as well as emulsifying and dispersing ability. It is suitable for jet and continuous bleaching systems.

Product Characteristics

Chemical Composition
Mixture of ethoxylated fatty alcohols

Appearance
Clear liquid

Ionicity
Nonionic

pH Value
7±1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Peformance Rating	
Wetting-Sinking performance	★★★★★
Oil-stain removal performance	★★★★
Foaming (25°C)	★★★★
Capillarity	★★★★★
Ion binding	★★★
Suitability for automation	☑
Desizing	★★★

DENOVA BLEACH NEW

Combined bleaching material that works with lower caustic soda amount, suitable for exhaust bleaching processes at low temperature.

Product Characteristics

Chemical Composition
Special combination of bleaching activator and surfactants

Appearance
Blue liquid

Ionicity
Nonionic

pH Value
7,5 ± 0,5

Application Methods

- ☑ Exhaust
- ☐ Cold Pad-Batch
- ☐ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★
Oil-stain removal performance	★★★
Foaming (25°C)	★★★★★
Capillarity	★★★★★
Ion binding	★★★
Suitability for automation	☑

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

DENWET BLS

Anionic, foam-free rapid wetting agent. Suitable for exhaust bleaching processes.

Product Characteristics

Chemical Composition
Combination of surfactants

Appearance
Yellow/Slightly turbid liquid

Ionicity
Anionic/ Nonionic

pH Value
7±1

Application Methods

- ☑ Exhaust
- ☐ Cold Pad-Batch
- ☐ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★
Oil-stain removal performance	★★★
Foaming (25°C)	★★★
Capillarity	★★★★
Ion binding	★★★
Suitability for automation	☑

DENKOM SRM

Concentrated nonionic wetting agent with foam-controlled, high washing efficiency, good dispersing effect, providing high hydrophilicity to the product. Suitable for all discontinuous and continuous methods.

Product Characteristics

Chemical Composition
Combination of ethoxylated fatty alcoholsı

Appearance
Slightly opaque liquid

Ionicity
Nonionic

pH Value
7,5 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★★
Oil-stain removal performance	★★★★
Foaming (25°C)	★★★★
Kapilarite	★★★★★
Ion binding	★★★★
Suitability for automation	☑

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

DNG MARINE SAFE

Clay-based, concentrated, high-stability combined bleaching material with good dispersing and washing properties, used in bleaching processes where a high degree of whiteness is required.

Product Characteristics

Chemical Composition
Combination of clay-based inorganic compounds

Appearance
Beige liquid

Ionicity
Anionic/Nonionic

pH Value
3,5 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch)
- ☐ Pad-Steam

Performance Rating

Wetting-Sinking performance	★★★
Oil-stain removal performance	★★★★
Foaming (25°C)	★★★★★
Capillarity	★★★★
Ion binding	★★
Suitability for automation	√

DENOVA PB MAX

Specially formulated pretreatment chemical with good wetting properties for desizing and scouring processes in one step without the need for enzymatic desizing in woven fabrics. Provides the product with high tegewa value, good hydrophilicity and whiteness properties.

Product Characteristics

Chemical Composition
Synergetic combination of special surfactants and dispersing agents.

Appearance
Clear colorless/Yellowish liquid

Ionicity
Amphoteric-Nonionic

pH Value:
7 ± 1

Application Methods

- ☐ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Wetting-Sinking performance	★★★
Oil-stain removal performance	★★
Foaming (25°C)	★★★★
Capillarity	★★★★
Ion binding	★★
Suitability for automation	√
Desizing	★★★★★

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE √√ UNSUITABLE √

DENWET AFM NEW

Denwet AFM NEW is a combination pretreatment material used in pretreatment process of cotton woven fabrics. Due to its special formulation, it desizes in one step and provides the fabric high hydrophilicity and whiteness.

Product Characteristics

Chemical Composition
Synergetic combination of special surfactants and dispersing agents.

Appearance
Clear/Slightly turbid Yellowish liquid

Ionicity
Nonionic

pH Value
7,5 ± 1

Application Methods

- ☐ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Wetting-Sinking performance	★★★★
Oil-stain removal performance	★★★
Foaming (25°C)	★★★★
Capillarity	★★★★
Ion binding	★
Suitability for automation	√
Desizing	★★★★★

ECO CLEAN

Combination bleaching agent used for low temperature bleaching and desulfurization of viscose fabrics.

Product Characteristics

Chemical Composition
Mixture of anionic actives and oxygen-based bleaches

Appearance
White powder

Ionicity
Anionic

pH Value:
11 ± 1 (1 % solution)

Application Methods

- ☑ Exhaust
- ☐ Cold Pad-Batch
- ☐ Pad-Steam

Performance Rating

Wetting-Sinking performance	★★★★
Oil-stain removal performance	★★
Foaming (25°C)	★★★★★
Capillarity	★★★★★
Ion binding	★
Suitability for automation	√

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE √√ UNSUITABLE √

14.2. Deaerating Agent

NONAIR PB NEW

Nonionic, foam-free wetting agent with very fast wetting and deaerating properties, especially used in yarn and woven fabric pretreatment...

Product Characteristics

Chemical Composition
Combination of special surfactants and phosphonates

Appearance
Clear/Colorless liquid

Ionicity
Anionic/Nonionic

pH Value
8 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★★
Foaming (25°C)	★★★★★
Suitability for automation	☑
Whiteness	

DENOVA SPEEDY

Multi-purpose anionic wetting agent with serial wetting, leveling, dispersing and antistatic properties and can be used in pre-treatment, dyeing and printing. Suitable for exhaust and continuous processes.

Product Characteristics

Chemical Composition
Synergetic combination of special esters and surfactant polymer

Appearance
Clear colorless liquid

Ionicity
Nonionic

pH Value
2 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★★
Foaming (25°C)	★★★
Suitability for automation	☑
Whiteness	

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

14.3. Oil Removing Agents

DEFATEN NOS CONZ NEW

Nonionic, concentrated, highly effective oil remover ith high emulsifying property. Suitable for automation.

Product Characteristics

Chemical Composition
Combination of special surfactants and phosphonates

Appearance
Clear/Colorless liquid

Ionicity
Anionic/Nonionic

pH Value
8 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★★
Oil-stain removal performance	★★★★★
Foaming (25°C)	★★★★
Capillarity	★★★★★
Suitability for automation	☑
Desizing	★★

DEFATEN FX

Anionic/nonionic oil emulsifier, especially used in padder for emulsifying lycra oils in pre-fixation. Suitable for automation.

Product Characteristics

Chemical Composition
Combination of ethoxylated fatty alcohols and esters

Appearance
Colorless liquid

Ionicity
Anionic/Nonionic

pH Value
2,5 ± 1

Application Methods

- ☑ Exhaust
- ☐ Cold Pad-Batch
- ☐ Pad-Steam

Performance Rating	
Wetting-Sinking performance	★★★★
Oil-stain removal performance	★★★★
Foaming (25°C)	★★★★
Capillarity	★★★★
Suitability for automation	☑

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

DEFATEN NOS

Nonionic, foam-controlled oil remover with highly effective emulsifying and washing properties. Suitable for automation.

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Product Characteristics

Chemical Composition
Combination of ethoxylated fatty alcohols

Appearance
Clear liquid

Ionicity
Nonionic

pH Value
8 ± 1

Performance Rating

Wetting-Sinking performance	★★★
Oil-stain removal performance	★★★★★
Foaming (25°C)	★★★★
Capillarity	★★★★
uitability for automation	☑
Desizing	★★

DEFATEN FSP

Strong nonionic oil remover with very high hydrophilicity and washing properties. Not suitable for automation.

Application Methods

- ☑ Exhaust
- ☐ Cold Pad-Batch
- ☐ Pad-Steam

Product Characteristics

Chemical Composition
Combination of ethoxylated alcohols.

Appearance
Clear colorless liquid

Ionicity
Nonionic

pH Value
7 ± 1

Performance Rating

etting-Sinking performance	★★★★★
Oil-stain removal performance	★★★★★
Foaming (25°C)	★★★★
Capillarity	★★★★★
Suitability for Automation	

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

14.4. Sequestering Agents

DENRAW N40 NEW

Polyacrylate based sequestering agent with high dispersion, ion binding and water softening properties. Due to its polyacrylate structure, it provides safe use in dyeing processes.

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Product Characteristics

Chemical Composition
Combination of polymers

Appearance
Colorless/Yellow-brownish liquid

Ionicity
Anionic

pH Value
7,5±1

Performance Rating

Fe^{+2} binding	★★★★
Ca^{+2} binding	★★★★★
Water softening	★
Dispersion	★★★★★

DENRAW NBP

Concentrated washing material with high dispersion, ion binding and water softening properties. Suitable for use in all textile pretreatment and dyeing processes.

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Product Characteristics

Chemical Composition
Combination of polymers

Appearance
Yellow/Brown liquid

Ionicity
Anionic

pH Value
5 ± 0,5

Performance Rating

Wetting-Sinking performance	★★★★
Oil-stain removal performance	★★★★★
Foaming (25°C)	★★★★
Capillarity	★★★★★

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

DENQUEST CONZ

Phosphonate-based, concentrated sequetering agent used in scouring and washing processes to obtain a uniform dyeing, and prevents fabric distortion. The complexes formed by **Denquest Conz** are stable at all temperatures and do not decompose.

Product Characteristics

Chemical Composition
Combination of phosphonates

Appearance
Clear yellowish liquid

Ionicity
Anionic

pH Value
1,5 ± 0,5

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Fe^{+2} binding	★★★★★
Ca^{+2} binding	★★★★
Water softening	★★★
Dispersion	★★★

DENQUEST HYN

Special polymers and acrylates combinaton sequestering agent. It is used in scouring and washing processes, as well as in dyeing baths to obtain a uniform dyeing and to prevent the catalytic effect by trapping heavy metal ions.

Product Characteristics

Chemical Composition
Polymers

Appearance
Yellow/Light brown liquid

Ionicity
Anionic

pH Value
7 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Wetting-Sinking performance	★★★
Oil-stain removal performance	★★★
Foaming (25°C)	★★★★
Capillarity	★★★★★

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

DENQUEST DAM

Used as an sequestering agent. It is an excellent demineralization agent for continuous processes. Increases fabric whiteness.

Product Characteristics

Chemical Composition
Combination of phosphonates and carboxylic acid

Appearance
Yellow liquid

Ionicity
Anionic

pH Value
2 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Wetting-Sinking performance	★★★★★
Oil-stain removal performance	★★

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

14.5. Stabilizers

DENSTAB PB OXI

Stabilizer that provides controlled decomposition of peroxide in the process bath when bleaching cotton products with hydrogen peroxide.

Product Characteristics

Chemical Composition
Combination of organic acid and salts

Appearance
Clear yellow liquid

pH Değeri
2 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Stability Test	★★★★★

DENSTAB PB OXI CONZ

Concentrated stabilizer that provides controlled decomposition of peroxide in the process bath for bleaching cotton products with hydrogen peroxide.

Product Characteristics

Chemical Composition
Combination of carboxylic acids and organic salts

Appearance
Clear yellow liquid

pH Değeri
7 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Stability Test	★★★★★

Denstap HP

Stabilizer used in hydrogen peroxide bleaching of cotton and synthetic-cotton blends.

Product Characteristics

Chemical Composition
Phosphoric acid ester with organic, inorganic salts

Appearance
Clear yellow liquid

Ionicity
Anionic

pH Value
7,5 ± 1

Application Methods

- ☑ Exhaust
- ☑ Cold Pad-Batch
- ☑ Pad-Steam

Performance Rating

Stability test	★★★★

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

14.6. Crease Inhibitors

DENGOLUBE PC

Oil based anti-crease, dispersing and leveling agent. Used in pre-treatment and dyeing baths.

Product Characteristics

Chemical Composition
Fatty acid condensation product

Appearance
Brown liquid

Ionicity
Nonionic/Anionic

pH Value
7,5 ± 1

Application Methods

- ☑ Pretreatment
- ☑ Dyeing

POLYMER ECO

Polymer-based running crease inhibitor.

Product Characteristics

Chemical Composition
Nonionic polymers

Appearance
Colorless liquid

Ionicity
Nonionic

pH Value
5,5 ± 2

Application Methods

- ☑ Pretreatment
- ☑ Dyeing

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

14.7. Enzymes

DENGLASE PRET

Alpha amylase based desizing enzyme.

Product Characteristics

Chemical Composition
Alpha amylase

Appearance
Clear light yellowish liquid

Ionicity
Nonionic

pH Value
7 ± 1

ANTIPER HEC

Concentrated Catalase-based anti-peroxide enzyme

Product Characteristics

Chemical Composition
Catalase enzyme

Appearance
Dark Brown

Ionicity
Nonionic

pH Value
6 ± 0,5

DENPOL NS CONZ

Concentrated Cellulase based biopolishing (anti-pilling) enzyme.

Product Characteristics

Chemical Composition
Neutral Cellulase enzyme

Appearance
Brown liquid

Ionicity
Nonionic

pH Value
5 ± 0,5

VERY GOOD ★★★★★ GOOD ★★★★ MEDIUM ★★★
SUITABLE ☑☑ UNSUITABLE ☑

TEST METHODS AND CONVERSION TABLES

15. TEST METHODS AND CONVERSION TABLES

CONVERSION FACTORS FOR HYDROGEN PEROXIDE			
H_2O_2	30%	35%	50%
30%	1.00	0.84	0.56
35%	1.19	1.00	0.66
50%	1.79	1.51	1.00

CONVERSION FACTORS FOR WATER HARDNESS			
	German Degrees	**French Degrees**	**English Degrees**
1° German Degree	1	1.79	1.25
1° French Degree	0.56	1	0.7
1° English Degree	0.8	1.43	1

11° German Hardness= 10 mg/L CaO
1° French Hardness= 10 mg/L $CaCO_3$
1° English Hardness= 14.254 mg/L $CaCO_3$.

15.1. Determination Of Hydrogen Peroxide Concentration In Continuous Bleaching Bath

A titration flask is filled with 20-30 ml of sulfuric acid 20%and 10 ml of the solution sample taken from the bleaching bath is added. Subsequently, it is titrated with the n/10 KMn04 solution until a pale pink color is obtained (the pink color should remain for about 1 minute).

EXAMPLE: 8.5 ml of n/10 KMn04 was used to titrate 10 ml of bleach solution. So, the amount of peroxide in 1 liter of bleach bath is:

50% H_2O_2 ml/L:

Consumption of 0.1 N KMn04 (ml) x 0.283

(8.5 x 0.283 = 2.41 ml/L H_2O_2 (50%)

35% H_2O_2 ml/L:

Consumption of 0.1 N KMn04 (ml) x 0.429

(8.5 x 0.429 = 3.66 ml/L H_2O_2 (35%)

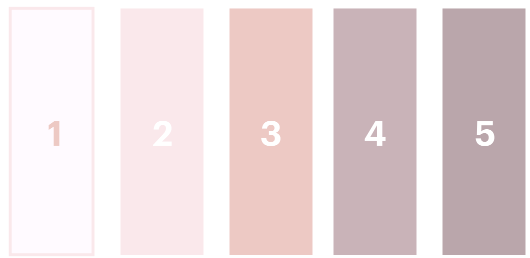
AMOUNT OF H_2O_2 IN BLEACHING BATH (In 2 mL Bleaching Solution)			
N/10 $KMNO_4$ CONSUMPTION (mL)	H_2O_2 35% mL/L	H_2O_2 50% mL/L	H_2O_2 100% mL/L
0,20	0,5	0,3	0,2
0,40	0,9	0,6	0,4
0,60	1,3	0,9	0,5
0,80	1,7	1,2	0,7
1,00	2,2	1,4	0,9
1,20	2,6	1,7	1
1,40	3	2	1,2
1,60	3,5	2,3	1,4
1,80	3,9	2,6	1,6
2,00	4,3	2,9	1,7
2,20	4,8	3,1	1,9
2,40	5,2	3,4	2,1
2,60	5,6	3,7	2,2
2,80	6	4	2,4
3,00	6,5	4,3	2,6
3,50	7,5	5	3
4,00	8,6	5,7	3,4
4,50	9,7	6,4	3,9
5,00	10,8	7,1	4,3
5,50	11,8	7,8	4,7
6,00	12,9	8,5	5,1
6,50	14	9,2	5,6
7,00	15,1	9,9	6
7,50	16,1	10,6	6,4
8,00	17,2	11,4	6,8
8,50	18,3	12,1	7,3
9,00	19,3	12,8	7,7
9,50	20,4	13,5	8,1
10,00	21,4	14,2	8,5
11,00	23,6	15,6	9,4
12,00	25,7	17	10,2
13,00	27,9	18,4	11,1
14,00	30	19,9	11,9
15,00	32,2	21,3	12,8
16,00	34,3	22,7	13,6
17,00	36,5	24,1	14,5
18,00	38,6	25,5	15,3
19,00	40,8	26,9	16,2
20,00	42,9	28,4	17
30,00	64,3	42,5	25,5
40,00	85,8	56,7	34
50,00	107,2	70,9	42,5

15.2. Determination Of Sulfur On Fabrics

- Test fabric is weigthed 2 gr and cut into small pieces and placed in a 200 ml erlen-mayer flask.
- 8 gr of powdered zinc is sprinkled on the fabric pieces in the flask.
- The Erleneyer is shaken well so that the zinc dust penetrates the fabric
- 60% HCl is added to the flask so that the fabric is completely covered.
- The filter paper is wetted with PbS (Lead Acetat) and the mouth of the flask is closed with this filter paper. An important point to note here is that the flat surface of the filter paper is closed so that it faces the inside of the flask.
- The filter paper is wetted with PbS (Lead Acetat) and the mouth of the flask is closed with this filter paper. An important point to note here is that the flat surface of the filter paper is closed so that it faces the inside of the flask.

After the erlen's mouth is closed, the stopwatch is started and waited for 5 minutes. The resulting colour is evaluated according to the following scale.

A rating from 1 to 5 is given using the rating scale. 1 best (No Sulfur); 5 is given for the worst value



15.3. Determination Of Iron Ion On Fabrics

15.3.1. Preparation Of Iron Detection Indicator:

- 500 ml of 0.1 N HCl solution is poured into a 1000 ml beaker, 145 g of Ammonium Thiocyanate powder is added and it is dissolved by mixing with a glass rod.
- 100 ml of Acetic acid is added to the solution prepared above and The solution is stored in a 1 L black flask.(Iron indicator)
- The fabrics are layed on the glass surface smoothly and the fabric surface is wetted with an iron indicator and waited 3 min.
- It is checked whether there are red dots on the fabric. If there are, a piece of fabric is cut from the red side to be examined under the microscope.
- The cut fabrics are placed between the slides for proper placement in the microscope.
- If there is no color, there is no iron ion.
- Observation of a slight red color indicates the presence of metallic iron.
- The dark red tells you it has ionic iron (which comes from a chemical from water).

15.4. Determination Of Core pH On Fabric

- First, the pH meter is calibrated. A 0.1 M KCl solution is prepared. (Weigh 7.46 g KCl, add to the flask and make up to 1000 mL with water. The pH and temperature of the prepared solution are recorded).
- Approximately 5 mm pieces are cut from the fabric to be analyzed and 2 gr is added to each of the 3 flasks. 100 mL of KCl solution is put into the flasks. It is allowed to stir with a magnetic stirrer for 2 hours.
- The end of 2 hours ,the solutions are filtered with filter paper and each solutions transferred to each a beaker.
- In order to measure the pH of the filtered solution, the electrode is immersed in the 1st solution and left until the pH value is stabilized. This value is not recorded.
- Without washing the pH meter, it is immersed in the 2nd and 3rd solutions without mixing, and the pH values read are recorded. (The difference between the two values should not be greater than 0.2). The average of the two recorded values is taken as the core pH value.

15.5. Determination Of Oil Percentage On Fiber Or Fabric

- The sample taken from the fabric, yarn or fiber to be tested is kept in the desiccator for approximately 1-2 hours until constant weight is taken.
- The samples (3 each) are placed separately on the 3 Petry dish with the help of tweezers
- Weighs with an accuracy of ± 0.0001 (M1).
- Petroleum ether is taken into beakers under the fume hood and each of the test samples is placed in a different beaker, closed and left for 10 minutes.
- Test materials extracted from petroleum ether are kept in an oven at 105 C for 1 hour.
- The samples taken out of the oven are kept in a desiccator, which is also isolated from the external environment, for 1-2 hours.
- The weight of the samples kept in the desiccator until their weight is stabilized is weighed (M2).
- Calculation: % Oil amount = (M1-M2)/M1

15.6. Determination Of Peroxide Residual Amount In The Bleaching Bath

- To determine the amount of Hydrogen Peroxide remaining in the bath at the end of the bleaching process, 2 ml of solution is taken from the bath and poured into a 100-250 ml flask and 30 ml of distilled water is added to it.
- 10 ml of 10% H_2SO_4 solution is added onto the solution in the flask.
- Fill the burette with 0.1 N Potassium Permanganate solution.
- Titrate until the color of the solution turns pink. The volume of the spent solution is noted.
- Calculation:
- % Hydrogen Peroxide Amount (remaining pure from 50%) = (S x 1.7) / (M x 0.5)
- S: 0.1 N Potassium Permanganate consumption (ml)
- M: Sample amount (gr)

REFERENCES

PAMUKLU TEKSTİL MATERYALİNİN PEROKSİTLİ ORTAMDA AĞARTILMA REAKSİYONLARI VE KATALİTİK ETKİ
XVI. Ulusal Kimya Kongresi. A. AKDOĞAN ve A. KAYA
2002, Konya

Tekstil Üretimi ve Yardımcı Kimyasallar
TMMOB Kimya Mühendisleri Odası M. İLTER Mayıs 2015, İzmir

TEKSTİL ENDÜSTRİSİNDE YÜZEY AKTİF MADDELERİN KULLANIMI
TMMOB Kimya Mühendisleri Odası M. ÇİFTÇİ Aralık 2015, İzmir

EMÜLSİYONLAR; Modern Farmasötik Teknoloji
N. ÇELEBİ 2009, Ankara

TEKSTİL MALZEMELERİNDE KARŞILAŞILAN KUSURLAR, NEDENLERİ VE ÇÖZÜM ÖNERİLERİ
Türkiye Tekstil Sanayii İşverenleri Sendikası & Ege Üniversitesi Tekstil Mühendisliği Ekim 2016, İzmir

PAMUK VE DİĞER ELYAFLAR
Bossa T.A.Ş, V. ÖZEK, 2014, Adana

KATYONİK AĞARTMA AKTİVATÖRÜ KULLANARAK HİDROJEN PEROKSİT AĞARTMASININ PAMUKLU ÖRME KUMAŞLAR İÇİN OPTİMİZE EDİLMESİ
Semiha POLAT, Mayıs 2013, İSTANBUL

FABRIC FINISHING, PRETREATMENT/TEXTILE WET PROCESSING
P. HAUSER, W. SCHINDLER / Ağustos 2004, NC, USA

TEKSTİL TERBİYE İŞLETMELERİ BOYAMA VE KİMYA LABORATUVARLARI EL KİTABI
M. C. GEZEN, Ş. ABRAŞ, B. C. GÜLTEKİN, B. HARMANCIOĞLU, N. UHRİ, M. Y. KILIÇ, B. ÇİÇEKOĞLU
2003, İstanbul

TEKSTİL ÜRETİMİ VE YARDIMCI KİMYASALLAR
M. İLTER, Mayıs 2015, İzmir

MEGEP TEKSTİL TEKNOLOJİSİ, DOĞAL LİFLER
2014, Ankara

HAŞIL MADDESİ OLARAK POLİVİNİLALKOLLER;
A. KÖRLÜ, E. ALAY, 2011, İzmir

İTÜ KİMYA MÜHENDİSLİĞİ BÖLÜMÜ TEKSTİL KİMYASI DERS NOTLARI
O. İSMAİL, 2020, İstanbul

ULUDAĞ ÜNİVERSİTESİ TEKSTİL MÜHENDİSLİĞİ BÖLÜMÜ TEKSTİL ÖN TERBİYESİ DERS NOTLARI
P. ANİŞ, Bursa

https://karsu.com.tr/urunler/moda-iplikler/viskon/
https://www.benningergroup.com/fileadmin/user_upload/downloads/textile_finishing/only_en/ bleaching_en.pdf
https://www.benningergroup.com/fileadmin/user_upload/downloads/textile_finishing/only_en/ dyeing_en.pdf
http://www.kuesters-calico.com/wp-content/uploads/WET-PROCESSING.pdf

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