CONTINUOUS PROCESSES,
COLD PAD-BATCH DYEING
PROCESS
AND TAILING PROBLEM

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ABSTRACT

Dyeing cellulose takes great place in textile sector today. Dyeing cellulose is about %55 in textile sector in the world. The world textile consist of cellulose dyeing which is more than %50

There are various processes in cellulose in cellulose dyeing. The rates of applying of this process in the world textile sector are following:

**Exhaust:** 53, 13 Hot Dyeing 80 °C
             40 Cold Dyeing 60 °C

**Pad-Batch:** 15

**Pad-Dry-Pad-Steam:** 8

**Other Continue:** 3

**1-Phase Printing:** 15

**2-Phase Printing:** 6

The most important dyeing process of Europe textile sector about continue dyeing process is the Pad-Batch. Due to the most common process is Pad-Batch. The using rate of continue process in Europe are below:

**Pad-Batch:** 79

**Steam Process:** 17

**Other Continue:** 4
The dyeing of Pad-Batch is nearly %39 in continue process in USA, %21 in the Asia.

The rate of Pad-Batch among the continue process is %46 in the world, the rate of steam process is %46 and other continue process is %8. However these rates are different in Europe.

We can see the importance of Pad-Batch process in the continue dyeing from the numbers. With the thought of the importance of Pad-Batch’ I have searched many problems. The turning point of this study about continues dyeing is the tailing problem.

The study of project has realized especially in the Ciba Company I’m working for and Gerede Textile in Gerede/Bolu applying Pad-Batch Dyeing process.

Short time of later beginning dyeing, the colour difference exists between the first a hundred meters and the following length of fabric, which is called Tailing problem. There are several factors are evaluated below:

- Adjusting Machines
- Process Values
- Used Materials
- Environment Factor,
- Human Factor

During project study, I got some results of tests and experiments, the factors causing Tailing problem are evaluated.
ACKNOWLEDGEMENT

There is no way to fully acknowledge my depth to the many people contributing to this dissertation.

I am grateful to Ciba Special Chemicals Co. I am working for to enable me to work and carry out my studies.

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Finally, I would like to thank all my friends for their support and encouragement during this dissertation. I apologize for all the time I spent on it that I could have spent with them.
DEDICATION

To Ciba
and
The all GEREDDE TEXTILE stuff.
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### GLOSSARY OF TERMS

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<td>Dipsat</td>
<td>It is chemical troughs used before steaming unit in continues bleaching machine.</td>
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<td>Dispenser</td>
<td>It is an apparatus of automatic dye and chemical dozing used for laboratory colour studies.</td>
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<td>E-Control Process</td>
<td>It is the name of continuous dyeing process developed and carried out by Monforst.</td>
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<td>Hydrofilte</td>
<td>It is the power of fabric absorption.</td>
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<td>Hydrolyze, Hydrolyzed</td>
<td>The operation of excessive dye amount after fixation is called hydrolyzes; this excessive dye is called hydrolyzed.</td>
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<td>Dye Combination</td>
<td>The total dye used for obtain colour.</td>
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<td>Migration</td>
<td>It is the colour waving on the surface of fabric. It is especially on of the problems often faced to in fabric.</td>
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<tr>
<td>Neutralization</td>
<td>The operation made for acidic or basic bath PH 7</td>
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<tr>
<td>The Dye Penetration</td>
<td>The operation made for the absorption of dye on surface and in fibers.</td>
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<td>The Tension Of Winding Fabric</td>
<td>The tightness of winding fabric during winding.</td>
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<td>Dye Stability</td>
<td>It is the appropriateness of dye. It is the appropriateness of dye in combination or in its own structure.</td>
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<tr>
<td>Sanforization</td>
<td>It is a kind of finishing operation to correct the rate of fabric shrunken and supply regular surface of fabric.</td>
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**Background:**

As known, there are several process and methods in fabric dyeing. There are several machines and dyeing process resulting from bath the features of fabric and the aim of using fabric.

The aim of manager is to supply right, rapid, qualified manufacturing so satisfaction of customer and obtain high quality standards in fabric dyeing. The highest target is to carry out right manufacturing at first step. In addition to do it, technological improvement and world necessities lads us to make searches.

We have to take care of required precautions by adjusting improvement, improving ourselves and following technological improvement.

In textile sector semi fabric dyeing recently taken great importance. In Europe and Turkey, taken the most important process of semi continue dyeing is Pad-Batch.

Textile sector faces frequently problems such as other sectors. One of the most common problems in textile sector is tailing problem.
Chapter 1: INTRODUCTION

1.1 Definition Of Problem:

Tailing problem is frequently faced. Due to Pad-Batch dyeing process is commonly used; I prefer to search this process Pad-Batch machine and process conditions, human factor, materials used (Fabric, dye, chemical, water, etc.) cause problem. When we list the factors causing problem in Cold Pad Batch Dyeing Process.

The points To Be Cared In Cold Pad Batch Dyeing Process:

- Appropriate Fabric Humidity
- The Temperature Of Trough Entrance Before Dyeing
- The Tensions Of Machine Entrance
- The Consistence Of Pre-Treatment
- The Feature Of Tube Of Fabric
- Pressure Of Trough Squeezing
- The Control Of Width In Squeezing
- The Time Of Diving Of Fabric Into Trough
- The Penetration Of Dyeing On Fabric
- The Temperature In Padders
- Speed Of Machine
- Capacity Of Winding
- The Temperature Of Trough Bath
- The Cleaning Of Dyeing Trough
- The Temperature Of Dye Feed
- The Temperature Of Cooling Water
- The Temperature Of Winding
- The Temperature Of Winding
The Time Of Fabric Rotation After Dyeing
The Temperature Of Management Water
The Capacity Of Roll Of Fabric In Rollers
The smooth Of Seams On Fabric
Used Alkaline
Consistence Of Dye and Recipe
The Right Combination

1.2 Utility Of This Project:

There are several processes that have originated from both the machines and the materials used.

After the machine starts to produce, a colour difference exists between the first nearly 100 meters and the following length of fabric. At the same time, there is a fabric fixation problem owing to that process has been perfectly applied. The reason of this problem is not understood. Many experiments, tests, researches have been made by considering the caused effecting this problem however the main origin of problem has been not found.

That the machine is new and does not have established processes are as disadvantages. The furthermore, producing rapidly, being less harmful for environment, ecological and economic dyeing and acceptable quality are some of the innovations this machine provides.
Tailing problem increases our product cost and other losses. If give examples,

- Time Loss
- Energy Loss
- Raw Material Loss (Fabric, Dyestuff, Alkaline, Water, etc.)
- Customer Loss
- Stuff Loss
- Quality Loss
- Competition Loss
- Performance Loss

In order to increase manufacturing quality, we must consider our losses as company and follow improvement in textile sector. I believe this study help customer and manufacturers relevant to this issue.

1.3 The Methodology Of Solving Of Problem

By considering all possibilities causing problem, we must evaluate the problem.

In figure 1 below, the factors to be cared are indicated;
Figure 1: The Methodology Of The Solving Of Problem
Chapter 2: LİTERATURE REVIEW

2.1 Techniques Of Continue Dyeing

Generally continue dyeing process can be started as three main topics.

1-PAD-BAKE   2-PAD-STEAM   3-PAD-BATCH

These three continue dyeing process is applied in various types.

2.1.1 Pad-Dry-Pad-Steam Process

Pad-Dry-Pad-Steam Process in continuous dyeing process is the standard process in steam dyeing. It is generally suggested for long meters of fabric. It is suitable for fabric more then 500 meters it has a good stability of bath. Additionally, it is appropriate for bright colour. It has more control parameters. It is necessary to obtain suitable condition. Pad-Dry-Pad-Steam process is unproductive for short time lots.

Figure 2: Pad-Dry-Pad-Steam Process     (Search: Kuesters)
2.1.2 Pad- (Pad)-Steam Process

Cotton weaved fabric is generally dyed by continue process. The criteria defining which of Pad-Steam or Pad-Jig is prepared, is the feature of fabric such as the length type.

Long meters heavy mercerize weaved fabric is dyed by the method of Pad-Steam with distance drying.

Short meters fabric is dyed by the method of Pad-Jig, however the cost must be cared. Knitting fabric is not dyed by this method.

Dyeing by Pad-Jig methods without any instance drying supplies much more penetration and suitable. In bath of methods mentioned is prepared according to the position and feature of machines, but it is not suggested.

Pad-Steam process has more advantages to supply high production due to it is an easy process. It requires less investment and energy than Pad-Dry-Pad Steam. It has no possibility of migration. It includes fewer chemicals. It is the continue dyeing process used in big amount of fabric and viscose fabric. It includes tailing problem and it has limit to dye choose.

Figure 3: Pad -(Pad)- Steam Process  (Search: Kuesters)
2.1.3 Pad-Dry-Steam Process

Firstly, right prep operations must be done to realize good dyeing.

In Pad-Dry Steam Process, the satiation of colour is high. The possibility of colour difference and tailing is low. It does not include salt. It is more advantages than Pad-Dry-Pad-Steam process.

If fewer chemicals are wanted to be used and migration problem is faced, this process is prepared. It has the risk of dropping water. The adjustment of machine is too difficult because steaming and hot drying is close.

Figure 4: Pad-Dry Steam Process  (Search: Kuesters)
2.1.4 Pad-Dry (E-Control) Process

E-Control process is improved by the cooperation of Monforts Company. It is economical and with using of chemicals. It is rapid and new process realizing immediately washing after dyeing.

In this process steaming does not exist. With the %25 humidity, at the 110-130 °C cellulose dyeing at the 210 °C polyester dyeing is done. It is a suitable process for people wanting to pass entirely continues from cold Pad-Batch.

E-Control process is short and includes cost. It is usable with hot air drying and fixation continue dyeing process it includes less procedures and uses less chemicals so it has advantages. Its feature of reputability is great. Tailing problem is again encountered in E-Control process like the other process.
Figure 6: The Amount Of Using Chemicals of Different Process (Search: Monforts)

Alternatively Process
Relative Costs

(Search: Monforts)
2.1. Cold-Pad-Batch Process

Cold Pad Batch process is easy and practice process. With good trough and machine order, it carries out rapid dyeing operation. As we understand from its name, depending on type of dye we wait for dyeing fixation nearly 4-24
hours. It is advantages for concerning chemicals and using dye. It requires less energy. Control of machine is easier than steam dyeing. The adjustment of machines in Cold-Pad-Batch dyeing is easy, it does not like much time to start dyeing.

There are many factors to be controlled in Cold-Pad-Batch dyeing. In order to realize qualified dyeing, the all controls must be done well. When we through this process with detail; the whole Cold-Pad-Batch dyeing systems looks like each other. There are three pressures padders in continue process.

1-The Pressure Padders
2-Finishing Padders

(Search: Kuesters)

Figure 10a: Pressure Padders
Figure 10b: Finishing Padders
3-Dyeing Padders

Figure 11a: The Dyeing Padders

(Search: Kuesters)

Figure 11b: Dyeing Trough

(Search: Monforts)

Basically there are 3 samples for Dyeing Troughs;

![Figure 12: Trough Samples](Search: Kuesters)

In through example 1 and example 3, because the time of fabric diving is long, the fabric becomes wet. The way of diving is a distance from the first point of fabric touching bath to squeezing padders. Depending on the
hydrofility of fabric, the time of diving at each 2-4 is to be considered. Since renewal of bath at more volume through takes much time, risk of tailing problem occurs. The passing speed changes 25-60 minutes depending on the volume, weight and hydrofility of fabric.

The mixing of fresh dye bath coming from the tank of prep dye and the bath flowing from padders is easier in 1 and 3 through examples. Because of this fact, these two dye bath are mixed with the help of pomp in through in some systems. The fabric having such as velvet, knitting and towel is dyed by the method of through diving without exception.

When we look through the criteria’s in Cold-Pad-Batch dyeing Process;

Figure 13: The Criteria’s Of Pad-Batch Dyeing Process (Search: Kuesters)

1-The Humidity Of Fabric
2-The Mixing Of Dye Liquid
3-The Colour Measurement Of Dye Liquid
4-Fast and Good Cleaning System
5-Colour Kitchen
6-The Cooling System: (On the fabric, in dye trough, etc.)

6a- Cooling Of Fabric
6b- Cooling Of Dye Liquid
6c- Cooling Of Dye Tanks
6d- Cooling Of Dye Trough
7a+b- The Capacity Of Winding
7a- The Tantion Of Entrence
7b- The Tantion Of Ending
8- The Control Of Pressures
2.1.5.1 The Most Important Factors Of Cold Pad Batch Dyeing

Suitable Fabric Humidity

The temperature and humidity of fabric taken dyeing is important. The preparation, drying operation has to be done and particular temperature value and humidity must be included. The standard humidity of cellulose type fibers is %7 and the temperature of fabric 25 ºC. Namely, before dyeing the humidity of % 100 cotton fabric is %7, the temperature 25 ºC. According to the results of test in company, the value of humidity %100 cotton fabrics ready for dyeing is below.

Graph 1: Humidity Of Fabric Prepared Dyeing
The Temperature Of Fabric Before Cooling Padders

Before dyeing, the temperature of fabric must be in standard temperature. Because, the temperature resulted from fabric will increase the temperature of dye solution, before and after dyeing the temperature will increase and this will tailing problem.

When we look over the values realized in company; as indicated in graph 2, the average temperature is 26.481 ºC. This value is close to desired average value 20-25 ºC. But it is compulsory to supply 20-25 ºC. Cooling padders supply fabric cooling and combination before dyeing.

Graph2: The Temperatures Of Fabric Before Cooling Padders
The Temperature Of Fabric Before Trough Entrance

According to the results, the temperature of fabric declines after cooling padders.

Graph 3: The Temperatures Of Fabric Before Trough Entrance

Figure 14: Cooling Padders Of Pad-Batch Entrance
In the increase of temperature in summers, cooling ventilators can be used to cool and prevent flies putting on fabric so it prevents stain. (See figure 15)

Figure 15: Ventilator Of Cooling

The Temperature Of Fabric At The End Of Trough After Dyeing

One of the important temperatures of fabric is the temperature of fabric at end of trough. The changing of temperature caused by bath dye solution and the temperature of manufacture water affects fabric temperature. The value temperature from dyeing is below:

Graph 4: The Temperatures Of Fabric Trough Exist
The Temperature Of Fabric At The Entrance Of Washing After Waiting (Rotation)

The all factors likely to affect colour after and before dyeing have to be cared and necessary precautions must be taken. As it is known, in the Pad-Batch Process wounded fabric rollers after dyed must be waited in the conditions of manufacture. (4-24 hours, depending on kind of fabric and dyestuff) This waiting temperature is vital since our waiting conditions normal atmosphere conditions; it differs depending on winter and summer over country and region. In winter, manufacture temperature 0 ºC; in summer it is 35 ºC. So it is inevitable to be different colours. Therefore, this problem resulted from changing must be not neglected. In some companies, dyed part is conditioned by condition equipment so the same humidity and temperature are supplied.

In the result of experiments made in April, when the average manufacture temperature is 15-16 ºC, the measurement of temperature of fabric is;

Graph 5: The Temperatures Of Fabric Afterward Waiting, Before Washing
The Measurement Of Temperature in Dyeing Trough:

Since the excessive and insufficient temperature resulted from fabric bath manufacture water and cooling water and cooling water influence dyeing through, the temperature in dyeing through is suitable to be fix and 20-25 ºC. In summer at the 35-40 ºC, the temperature of dyeing through will be excess. At the same time, the temperature coming from manufacture water and fabric will change. Since this kind of the excess of temperature exist. It is right to cool dyeing through by cooling systems and it enables to get good trough temperature.

Thanks to cooling system likely to supply cold water circulation around through, the bath temperature is supplied not to be over 25 ºC. 25 ºC is desired value. According to the experiments, the measurement of Pad-Batch dyeing trough bath temperatures is below;

As it is seen in graph 6, much excessive increase does not occur, the temperature after the beginning of dyeing gradually increases. The dye started with the temperature 21.5 ºC results 25.5ºC. The values do not cause great changes by the effect of bath cooling padders and the cooling system in the trough bath.

Figure 16: The Cooling System Dye Trough (Search: Gerede Textile)
Graph 6: The Temperature Of Dye Trough (The measurements are made during period from beginning dyeing to end of dyeing)

The Measurement Of PH at the Trough Bath

From the period of the beginning of dyeing to the end, PH in dyeing bath must be fix and desired value. If we realize dye by different PH bath, the effect of dye on fabric will be different, that is tailing problem will occur. Therefore, PH in trough has to be checked periodically. In the pipeline, between pomp and dyeing trough time to time there is water and the remains inherited previous dyeing. So the dye solution at the beginning of dyeing and dye solution at the end of renew and changed dyed are different. Due to it, some manufacturer empty fist dye bath and take new dye into trough. In some manufactures, this operation is carried out automatically. First bath is fulled up by flowing and the setting free pipe is leaved open 1-2 minutes. When we think about the renewal of the bath per 2 minutes, first bath is sent to setting free and
this bath enables to clean water and dye remain from pipe and trough before dye.

In addition the PH of bath of manufacture water and water used in laboratory must be 6.5-7.

7: The Measurement Of Dye Trough

Dye Sprinklers in Dyeing Trough

There are sprinklers pipes supplying to disperse dye equally on the surface of trough. (See Fig.17) This sprinklers cause to stopped up so entirely cleaning cannot be done. Particularly after dark colour dyeing. This leds to mix dark colour and light colour during dyeing later. Therefore different sprinklers pipes must be used for light and dark colour and the cleaning of pipes must be done.

Figure 17: The Sprinkles Of Dyeing Trough

(Search: Gerede Textile)
2.2 The Study Of Laboratory

In the study of laboratory colour is one of the important issue in manufacturing. Whether this study on laboratory is right reflects manufacture. Therefore, the study in laboratory must be done well and correctly.

Great investments are recently done in textile sectors. Electronically apparatus must be prepared. (e.g.) Dispenser dye solution maker, colour measurement apparatus.

The work conditions in laboratory and manufacture must be continuously controlled.

When We Look Through The Necessary Matters Cared In Pad-Batch Dyeing Laboratory;

Dye Bath Temperature
The temperature of the dye bath to be dyed in laboratory and the temperature of trough must be supplied to be equal (20-25 ºC desired)

Pick-Up
The rate of pick up in sample of padder and the rate of pick up in manufacture must be equal or manufacture laboratory colour equality must be supplied. (The ideal pick-up is 65-70 %)

The Time Of Diving
The time of fabric diving into dyeing trough and dyeing diving in manufacture must be same. (2-4 seconds is desired in the time of diving)

The Time Of Waiting
The time of waiting the sample of dyed fabric must be the same with the time suggested (4-24 hours depending on the kind of dye)
The Temperature Of Waiting

The waiting temperature of sample dye must be equal with the dyed fabric in manufacture. The sample to be waited has been cared to be winded with nylon. (Desired waiting temperature is 20-25 °C)

The Appropriateness Of Used Fabric

The sample fabric used in laboratory and the fabric to be dyed in manufacture must be cared to be some and the appropriateness (The control of hydrofoils, PH, Peroxide, Sizing must be done)

The Appropriateness Of Dye Solution

The dye solution prepared for sample dyeing is to be prepared in suitable temperature (20-25 °C ), the mixture of alkaline must be done before dyeing operation. The dye solution mixed with alkaline must not certainly waited. Waited mixture solution is hydrolyzed. (See Fig.18)

Figure 18: The Sample Of Hydrolyzed Dye

1: Unwaited Done The Sample Of Dye Solution,
2: The sample Of Dye Solution waiting a min.
3: The sample Of Dye Solution waiting 3 mins.
4: The sample Of Dye Solution waiting 5 mins.
5: The sample Of Dye Solution waiting 10 mins.
6: The sample Of Dye Solution waiting 20 mins.
7: The sample Of Dye Solution waiting 30 mins.

**The Speed Of Passing Fabric**
The speed of sample dyeing machine in lab and the machine in manufacture must be adjustment in appropriate with colour.

**Constant and Right Washing**
The washing of dyed samples done carefully. Depending on the kind of fabric, the temperature of drying must be determined and drying must be realized at the high temperature. 60 °C is suitable temperature for drying. However depending a kind of fabric, the short time drying. This temperature can up 100 °C.

**The Operation Of Drying**
Depending on the kind of fabric, the temperature of drying must be determined and drying must be realized at the high temperature. 60 °C is suitable temperature for drying. However depending a kind of fabric, the short time drying. This temperature can up 100 °C.

**Right Combination**
The dye combination to be used must be noticed to be same with suggested combination by manufacture; suggested dye combination must be used.

**Right Alkaline**
The feature of used alkaline must be same with the alkaline used in manufacture.

**The Appropriateness Of Used Water**
The temperature of water used for preparation solution must be 20-25 °C. Moreover, while preparing solution, hot water not obviously used.
2.3 Dye Kitchen and The Operations Of Preparing

After the laboratory works, the dye for the fabric to be prepared for dyeing is prepared in dye kitchen. Prepared recipe is essentially considered; the recipe is prepared in appropriate with the kind and amount of fabric. The amount of alkaline changes according to the compares. The main principle about rate of dye is 4, rate of 1. (800 liters dye, 200 liters alkaline)

The operation of preparing dye must be carefully made. The dye solution must be at the temperature of 20-25 °C. It is compulsory to solue dye well. The urea can be used to make easy solution on dark turquoise colours. While preparing dye solution, mixture must be used for mixing.

The amount of dye must be prepared carefully; the level of water in trough must be controlled. Moreover, this indicator to be digital and automatic is beneficial.

Excess or less solution especially in light colours leds colour difference problem.

Degree of Caustic and silicate Bome as used alkaline must be controlled. Alkaline must be taken into manufacture by controlling. Caustic used for dyeing must be 38 °C. Generally 50 °C Caustic is taken to manufacture and this is declined 38 °C. It must be controlled whether it is at this degree. This degree for dyeing is suitable. Additionally silicate to be used must be 40 °C. This fact is beneficial to control.

Dye and alkaline solution are got together at the pomp before dyeing and this pumps to the pumps to the dyeing trough. After starting to pump, the dyeing operation must be start, dyeing must be started not be hydrolyzed.
Figure 19: The Tanks Of Alkaline and Dyestuff (Search: Gerede Textile)
2.4 Operation Of Pre-Treatment

Pre-treatment of fibers in cellulose type must be done before dyeing. The Pre-treatment of fabric is vital. Therefore, pre-treatment operations must be done well and the elements affecting quality must be under control. Pre-treatment operations of fabric in cellulose type essentially look like each other.

2.4.1 Operation Of Singeing

As it has been known, in order to remove the feather on the surface of fabric and supply the smoothness of fabric, the singeing operation is realized. By waiting for a while the sizing in cellulose must be ripped open. The sizing is used for supplying the sewing cotton being good and to weave.

Singeing are used such as starch singeing, PVA (Poly-Vinyl-Alcohol) and these singeing must be for away by pre treatment operations. Afterwards singeing operation, fabric passed the bath of singeing ripping open is waited in time of rotation units. (This time changes according to the chemicals used, but approximately 10 hours)

Before and after singeing
Enzyme Trough
60°C, PH: 5.5-6
Wetting (arbitrary)
To approve of ion Remover Enzyme
Destroy to air (arbitrary)
A. Acid (PH settings)

Figure 20: Singeing and Enzyme Machine (Search: Goller)

Figure 21: The Unit Of Rotation (For Singeing)
2.4.2 Operation Of Bleaching

One of the most operations in fabric dyeing is bleaching operations. Bleaching operations must be done well and correct fully to get regular and qualified dyeing. Bleaching operations depend on the kind of fabric. Hot steaming carries out bleaching operations of the fabric in cellulose type. Bleaching operation is essentially to get while fabric. The fabric ripped open singeing subjects to bleaching operation to whiten.

There are several factors to be considered during bleaching operations. First one or two troughs are hot washing trough in bleaching operation. E.g. Afterwards previous washing the bath is alone via the chemical called dipsat. (See figure 22). Fabric subjects to operations by chemicals such as caustic, hydrogen peroxide, to approve of ion, stabilazator making white and opening the fibers of fabric, increasing the absorption of fabric. Afterwards these chemicals, fabrics in cellulose type are applied the operation of steaming at 100°C in steam units. In this unit, depending on kind of fabric, the fabric is waited 10-20 minutes to realize fabric white in some kinds of fabric; the steaming operation cannot be done.

Steaming units are the units where the bleaching operations are realized and it is sensitive operation. Therefore waiting units must be continuously controlled. Because dropping risk originated from steam and waiting causes trace problem due to fabric waited in high temperature exist.

After steaming operation, washing baths exist. There are 3,4,5 washing cabins and these cabins are designed in different shape after bleaching washed fabric must be neutralization well. Because fabric passed from the chemicals affecting dyeing such as caustic, peroxide, by washing after bleaching and neutralization, fabric is removed from these chemicals. The PH of last bath in
bleaching must be adjusted as 5.5-6. Otherwise, fabric having caustic and peroxide remains causes problems during dyeing. In figure 22, we see the general view of bleaching operation.

![Diagram of bleaching machine]

**Figure22: The Sample Of Bleaching Machine (Search: Goller)**

**Good bleaching operation enables good dyeing. While applying bleaching operations, the criteria’s to be controlled are;**

**The Speed Of Machine:**

The speed has taken great importance. In some manufactures the speed is fixed unlike other manufactures. Some manufactures adjust the different speed according to the type of fabric. Speed must be some from the beginning of fabric to end; the machine must not be slow or stopped. Since slow operation and waited fabric surface trace and whiten problem.
The Period Of Waiting Bleaching Steam Unit and The Regularity Of Fabric

The period of waiting in bleaching steam unit must be adjusted carefully. The period of waiting is calculated by considering the whiteness of fabric and the operation of whiten coming true period. 13-15 minutes are sufficient for the moss waiting in waiting unit in good conditions. The extension of waiting depends on the type of fabric. According to the type of fabric, the bleaching operation without pilling up is realized. Waiting trace and broken problem must be cared. The dropping from steam and the effect of chemicals consisting foam via high temperature have to be considered. The bolt attached fabric sides and preventing broken must be chosen well not to make trace on fabric.

The Sleekness Of The Pumping Amounts Of Chemicals Pumped To Dipsat

One of the most important issues in bleaching operation is to pumping chemicals in regular and equal way. This point must be continuously controlled. The desired values are essentially registered icon the panel of bleaching machine and these values are pumped to the dipsat by pumps that is it is pumped by mixing the bath before the steaming unit. The results of approximate test values made through 1 year are in graphs below.
Graph 8: The Values Of Control Of Bleaching Chemical Pumps.

The Control Of The Bleaching Washing Water

Washing baths in the end of exit of bleaching must be some times controlled. PH of last neutralization bath must be especially measured. There are automatic apparatus of measurement of PH in last neutralization tank in many bleaching machines. However, this apparatus must be updated and confirmed periodically.
The Control Of Squeezing Padders At The Entrance Of Dipsat

In the bleaching operation, before the steaming unit, chemical bath that is the squeezing padders at the entrance of dipsat must be regularly controlled. Since it is done from wet to wet, it is vital.

Since side-middle-side difference likely to be originated from squeezing cannot happen, squeezing in equal power is required. That's over trough the surface of fabric; the pressure must be same level. As seen in figure 23, the pressure regularity and level of padders must be equal on whole surface.

![Figure 23: The Samples Of Pressure Padders (Search: Kuesters)](image)

There are various methods to control of regularity of pressure. Such as carbon test, powder test, pick-up test.

**Carbon Test:**

Setting a carbon paper in between paper in which length is up to padder does carbon test. The paper prepared by setting carbon between paper is set regularly among the padders and pressure applied in machine gives pressure to padder, paper afterwards waited 1-2 minutes are taken and then the regularity of
trace of carbon on the surface of paper is checked. The equal level of pressure on the surface is supplied.

If there is an irregularity of pressure of padder, it is understood from the trace originated carbon and the caution is taken immediately. By altering the adjustment of pressure or worn out padder, the padder pressure regularity is supplied.

**Powder Test**

It looks like carbon test but powder is spilled among the padders and the pressure-applied padders are given, the pressure trace powder made on padders is measured. According to the values, pressure is adjusted or padders are changed.

**Pick-Up Test:**

Fabric passing through padders realizes pick-Up test. 3-5 meters fabric likely to be tested is wetted by passing from wet trough with desired pressure values and passing padders in desired pressure stops machine. The fabric samples taken from right-middle-left parts of fabric are balanced immediately by putting nylon bag balanced before. Afterwards, the samples of fabric are dried till provide. Fixed balance and the wetting on the surface of fabric is determined via wet-dry rates. By evaluating the rates obtained the regularity of padders pressure is determined.

![Graph showing the pressure values of pressure padders](image-url)
Graph 9: The pressure Values Of Pressure Padders

Graph 10: The Pressure Values Of Pressure Padders Mercerize First Entrance

Graph 11: The Pressure Values Of Pressure Padders Bleaching (Dipsat) First Entrance
2.4.2.1 The Controls Of The Surface Of Bleaching Fabric

Absorbing Test (Capillarity Test)

Absorption test is the control of absorption power of bleached fabric. It is done to control the speed of absorption of dye through fabric. The coming to period to dye desired level is accounted by dispensing in drops on the end of bleaching dried fabric part port of small fabric parts in particular standards is dived in dye solution. (See fig.24). This period changes depending on the kind of fabric but 0-6 seconds are ideal period.

![Figure 24: The Control Of Fabric Surface](image)

The PH Control On Fabric

The fabric whose bleaching operation is completed must have appropriate PH level. Therefore, PH level on fabric is accounted by the special PH measurement solution to be dispensed in drops on fabric PH level on fabric is approximate 5.5-6 ideal. The control must be continuously done and it requires records.
The Control Of The Existence Of Enzyme

The enzyme of fabric coming to the phase of bleaching operation must be removed. Bleaching operation is done after enzyme removing and essentially enzyme removing is realized particularly. The fabric in whom bleaching operation is done must have no remains of enzyme. The solution used for special determining enzyme is dispensed in drops on fabric and the color changes are followed from the statistic. Namely, in starch enzyme control after solution is dropped on fabric, if the colour is yellow, it is understood that singeing (enzyme) is removed, if the colour is blue or purple it is the indicator that there is starch enzyme remain.

Peroxide Control

After the fabric whose bleaching operation is completed is dried, the control whether there is peroxide. The peroxide scale controls special peroxide control solution dropped on fabric such as enzyme and PH control.

The Existence Of Iron Control

The existence of control iron on the bleached fabric must be controlled. Iron ion generated bath machine and fabric. If the iron is seen on fabric, the caution must be taken immediately. The control of iron existence is done by the solution dropping on fabric. Dark pink or red colour indicates the iron existence.

The Control Of Whiteness

On of the most important criteria of bleaching operations is the degree or level of whiteness. Because of bath the changes of waiting period and chemical pumping amount during bleaching operation the difference of fabric whiteness occurs. Therefore, the whiteness of fabric after bleaching operation is beneficial to be measured. Since the whiteness alters according to the kind of fabric, considering this fact must do the evaluation.
The Control Of Trace Of Pilling Up Of Fabric

One of the vital issues during bleaching operation is trace originated from waiting. There is high temperature in cabins where steaming is realized and the fabric piled up by pleating, waiting pilling up trace is encountered. Because of the chemicals used for steaming, foam occurs. Therefore, the sufficiency of rate of wetting agent and stabilization must be controlled.

The Irregularly Of Sewing

The irregularly of sewing begins the opening good and goes on till end off process. Due to irregularity of sewing, many meters of fabric are wasted. Irregularity of sewing arises the impropriety of the sewing cotton and it causes trace in each windings. As a result of this, many meters of fabric are wasted. To prevent this problem the control must be entirely done.

Fractured Fabric Problem

The Fractured fabric problem taken great problem for textile managements and requires good control. The regular action of fabric without pleating is provided from pre-operation to final operation. Adjusting machines and controlling of squeezing tension, using clothespins, solve this problem. The machine operator must look through fabric during operation.

The Clothespin Problem

The clothespin used for bleaching operation and aimed to prevent fractured time causes trace. If clothespin used is metal, it is coated and causes trace on fabric. Therefore, clothespin must be less used and chosen to be good quality.
Cold Bleaching:

The bleaching operation of Lycra or some special fabrics being sensitive to the temperature is not done. Since these kinds of fabrics are sensitive to the temperature and the temperature is harmful to the fabric, low temperature bleaching operation is applied. Cold Bleaching is done in different ways depending on the type of fabric.

2.4.3 Operation Of Mercerize

In pre-treatment operations, mercerizing operations is extra operation. It is realized depending on whether the customer wants. Mercerized operation is realized to give a bright and regular appearance and increase the durability. Mercerized operation is based on the operation between low 28 °Be caustic and fabric. It is done by opening fibers of fabric and distending fibers. The opening and distending of fibers increase the durability. (In figure 25 below, the samples of fabric mercerized and unmercerized.

Figure 25: The Sample Of Merserized and Unmerserized Cotton
(Search: Odevim.com)
Basics Of Mercerization

- Significantly increases the colour depth
- Increase of dimension stability
- Increase of tensile strength
- Enhances the lustre
- Reduction of abrasion tendency
- Minimise effects of dead/immature cotton
- Reduction of wettability

Common faults in Pre-treatment

- Insufficient removal of lubricants, softeners and sizes
- Defects during singeing due to non-centred guide rollers; irregular flame, differences in moisture/humidity
- Differences in tension and faulty squeezing device
- Change in caustic soda concentration during mercerisation
- Inadequate neutralisation after mercerisation
- Overdrying of the goods
- Poor wetting properties and residues
2.5 Finishing Operations

The fabrics of whom dye operations are completed are subject to different finishing operations according to the customer demands. Final operations such as washing, drying, sanforization, are important and an operation wrongly or improperly applied cause fabric manufacturing in undesired and unacceptable appearance and quality. So finishing operations must be done carefully in right processes since washing and drying operations particularly affect the fabric dye or colour, these operations must be considered.

2.5.1 The Washing Operations Of Dyed Fabrics

The washing operation of dyed fabric is vital. The washing machines features are same. First are and second bath entirely with opened valve. Bath is continuously fresher. Main continues washing machines have 6-7 or 8 cabins. Temperatures are generally the same in reactive washings. When we give on example of reactive washing

![Diagram of washing operations](image)

Figure 26: Washing off Samples
The colour of bath water is washing bath is important. Good washing and the removing the hydrolyzed are necessary while dark colours are dyed, last bath colour in washing machines must be controlled. Figure above a sample of center colour washing solution is seen.

As seen, from the fourth bath, the solution is likely to be rinsed. In last two bath, hybridization must be removed. In figure 27, the samples of solutions taken from washing baths are indicated.

Additionally, PH of last bath must be adjusted as 5,5-6. Although there is PH meter in same washing machines, the truth of PH meters must be controlled.
2.5.2 Drying Operations

The drying operation of bath dyed fabric takes great importance. There are various drying operations. Drying operations are carried out in hot air, padders with hot steam or various ways. Generally in continuo process open and hot air blow-drying machines.

![Image: Open-end Stander Machine](image)

Figure 28: The Sample of Open-end Stander Machine (Search: Monforts)

While realizing drying operations, machine stops are done. Machines are time to time stopped to wind fabric. Rules in entrance and exit of machine or attach the guide at the end of drying. Dyed fabric is much dried and subject to temperature during stops. The colours affected temperature such as red has risks. So as soon as possible, machines must not stopped. On of the important point in drying machines is the exit of drying. The temperature of the cotton in the exit of drying is up to 50-60 °C. The fabric at this temperature is winded without cooling and sometimes fabric is dyed without waiting. This issue is dangerous for dyeing operation.

Though the cooling padders in dyeing machines decline the temperature of fabric, the conditions of fabric good conditioned before dyeing are better suitable. So the existence of cooling padders in exit of drying is advantages.
Chapter 3.0 THE EVALUATIONS OF COLOUR MEASUREMENT TAILING

The example of colour evaluation belonging to the dyed parties with pad-batch dyeing operation in Gerede Textile Company is below:

As seen in the graphs, after a period of beginning the dyeing (approximately 100-150 meters) both the value of ∆L* (Lightness) and ∆E* change. The colour as shade in first 100-150 meters is lighter. Afterwards it is stable and goes on in that way till the end of dyeing. Last 50 and 100 meters are darker.

The result of this is: The colour difference occurred in first meters at the beginning of dyeing are sourced from the factors and criteria’s in Cold Pad Batch dyeing mentioned. As stated in chapter 2.1.5.1, these variations in Pad Batch Dyeing process cause the colour difference and this issue lets much harm.

So as seen in the results obtained, the whole factors to be cared must be under control thus the errors will be declined.
Graph 12: ΔL* Values During Dyeing Process

Graph 13: ΔE* Values During Dyeing Process
Chapter 4.0 SUGGESTIONS

Pre-treatment operations are so important in all continuo dyeing. The better pre-treatment of fabric to be dyed is done, the better quality of dyeing you get. The quality of fabric must be considered in bath pad-batch process and other continuo dye process.

Before dyeing the all pre-operations first such as bleaching, mercerized, singeing must be checked and done well in order to realize good pad-batch, firstly dye manufacturing. It must not be in climate affecting temperature. As soon as possible, the conditions supplying temperature and humidity of dyeing being fixed must be considered. The fabric conditioned at fixed temperature will provide the repeatability of fabric dyeing one of the important points is the regularity of fabric temperature. The temperature of fabric before dyeing must not be over 25 °C and as soon as possible the temperature and fabric humidity must be fixed.

The changes of temperature in fabric will affect cooling systems arte beneficial to be used. Cooling padders, cooling ventilators, conditions apparatus etc.

Since one of the most important factors to be considered in pad batch dyeing is temperature, the temperature in this process must be fixed. The temperature in this process must be fixed. The temperature of dye solution, manufacturing water, fabric, fabric winding and after winding is important and ideal temperature must be 20-25 °C.
The dye and chemicals used must be cared and suitable dye and chemicals have to be used. Dye combination must be appropriate with the combinations. Suggested by dye companies and good dye must be chosen.

Preparing and solving dye must be done carefully. Laboratory studies must be sensitive, reliable and repeatable. The minor error in laboratory causes big problems and wrong producing in manufacturing.

The final operations after dyeing are so important. It must not be forgotten that any chemicals and soften used will affect the colours.

The quality control operations are essentially such minor of manufacturing. Faults must be determined and statistical data must be obtained. As a result of statistical data, corrective and preventive actions are realized according to the rates of fault.

Whole factors in Pad-Batch dyeing are tried to explain in project. Since every manufacturing especially textile manufacturing encounter various problems every day. Due to it, the whole factors causing problem must be under control.
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