



Faculty of Engineering

Department of Textile Engineering

**STUDY OF THE EFFECTS OF PADDING
PRESSURE ON PIGMENT DYEING OF COTTON
WOVEN FABRIC**

Course code: TE 4214 Course title: Project (Thesis)

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(A thesis submitted in partial fulfillment of the requirements for the degree
of **Bachelor of Science in Textile Engineering**)

Advance in Wet Processing Technology

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Sumon Mojumdar, Assistant Professor**, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We also declare that, neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

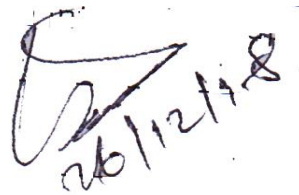
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LETTER OF APPROVAL

This project report prepared by **Rasel Ahmmed**, ID: **151-23-4275** and **Md. Rakibul Hasan** ID: **133-23-3638**, is approved in Partial Fulfillment of the Requirement for the Degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING. The said students have completed their project work under my supervision. During the research period I found them sincere, hardworking and enthusiastic.

A handwritten signature in black ink, followed by the date '26/12/18' written below it.

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Finally, we would like to express a sense of gratitude to our beloved parents and friends for their mental support, strength and assistance throughout writing the project report.

DEDICATION

This projects report is dedicated to “Our Parents & Teachers”

ABSTRACT

The aim of my research work was to “study of the effects of padding pressure on pigment dyeing of cotton woven fabric”. This study makes an assessment on the effect of Padding machines Pressure on Woven Fabric. To continue this process work we have taken nine samples of a woven fabric. At first we have done the all of mixing process and then for dyeing we have used padding machine. Then we see all the procedure of padding machine what actually happen in this machine during fabric treatment or finishing. To perform this work standard procedure was followed. After critical analysis, we have found that the changes of fabric quality after dyeing of different pressure. The project is mainly focused on the effect of different pressure of padding machine on the pigment dyeing process of cotton woven fabric. The aim of the work was to measure the GSM, EPI, PPI, Color change to wash, Staining change to wash, Rubbing property of finished fabric (dry and wet). In the experimental details we put some chemical name and their function. Here we put our sample specification. Our sample was 100% cotton woven plain fabric sample. In the discussion of result we describe that we gained in this thesis by some graph. The following graphs are describing the result of thesis. In the last, in appendix we put some tables where we described our Wash fastness to color wash fastness to staining, rubbing fastness at dry sample rubbing fastness at wet sample, GSM before and after dyeing, EPI before and after dyeing and PPI before and after dyeing is described in details. By this experiment we gain knowledge such as when the pressure of padding machine is increased in the time of dyeing the GSM, EPI, PPI is decreased. We know that the rubbing fastness of pigment dyeing fabric is very bad that’s why the result of rubbing fastness report is very low in our experiment. Like in the time of 1 Mpa pressure the rubbing fastness is 1 out of 5.

TABLE OF CONTENTS

CONTENTS	PAGE NO.
ACKNOWLEDGEMENT	IV
DECLARATION	V
ABSTRACT	VI
LIST OF CONTENTS	VII
LIST OF FIGURES	VIII
LIST OF TABLES	IX
Chapter-1: INTRODUCTION	1-2
1.1 Introduction	2
1.2 Object of the study	2
Chapter-2: LITERATURE REVIEW	3-18
2.1 Cotton	4
2.2 Weaving	5
2.3 Woven Fabric	8
2.4 Pigment	11
2.5 Padding Mangle	16
Chapter-3: EXPERIMENTAL DETAILS	19-24
3.1 Material	19
3.2 Method	20
3.3 Method of Evaluation	23
Chapter-4: DISCUSSION OF RESULTS	30-34
4.1 Column diagram of Wash fastness of color change of fabric under different pressure of padding machine	31
4.2 Column diagram of Wash fastness of color change of fabric under different pressure of padding machine	32
4.3 Column diagram of Rubbing fastness of Staining change (dry) of fabric under different pressure of padding machine	33

4.4 Column diagram of Rubbing fastness of staining change (wet) of fabric under different pressure of padding machine	34
CHAPTER-5: CONCLUSION	38
REFERENCE	39
APPENDIX	40-43

List of Figures

Figure No.	Title of the Figure	Page No.
Figure 2.1	Cotton fiber shrub	04
Figure 2.2	Structure of woven fabric	09
Figure 3.1	Padding Mangle Machine	18
Figure 4.1	Column diagram of change in GSM of fabric under different pressure of padding machine	31
Figure 4.2	Column diagram of change in PPI of fabric under different pressure of padding machine	32
Figure 4.3	Column diagram of change in EPI of fabric under different pressure of padding machine	33
Figure 4.4	Column diagram of Wash fastness of color change of fabric under different pressure of padding machine	34
Figure 4.5	Column diagram of Wash fastness of Staining change of fabric under different pressure of padding machine	35
Figure 4.6	Column diagram of Rubbing fastness of staining (dry) change of fabric under different pressure of padding machine	36
Figure 4.7	Column diagram of Rubbing fastness of staining (wet) change of fabric under different pressure of padding machine	37

CHAPTER-1

INTRODUCTION

CHAPTER-1

INTRODUCTION

1.1. Introduction:

Pigment **dyeing** is not really "dyeing" in its truest form because the pigments stick on the fabric with the help of binders. Pigments are insoluble in water. They exist in the form of finely ground molecules, milled for garment dyeing purposes into a paste. When anionic dispersing agents are added, a slightly negative charge is present, thus the foundation for pigment dyeing is born.

When a positively charged cationic pre-treat is added to the fiber a magnetic bond is formed. The process is complete when a cationic binder is added to "lock" the pigment into place. In pigment dyeing no actual chemical reaction takes place between the dye and the fabric.

1.2. Objectives of the study

The **Broad objective** of the study is to the effects of padding pressure on pigment dyeing of cotton woven fabric.

The specific objectives are:

- ✚ To evaluate about the pigment dyeing by padding mangle machine effect of cotton woven fabrics by color fastness test and rubbing test.
- ✚ Well known about pigment dyeing process and pigment dyes.
- ✚ To evaluate different characteristics of cotton woven fabrics after dyeing process, including CPI, WPI and GSM.
- ✚ We can also know about padding machine.
- ✚ Deep knowledge about fabric characteristics at different pressure of padding machine.

CHAPTER-2

LITERATURE REVIEW

CHAPTER-2

LITERATURE REVIEW

2.1. Cotton

Cotton is a soft, fluffy staple fiber that born in a boll, around the seeds of the cotton plants of the genus *Gossypium* in the mallow family *Malvaceae*. The fiber is pure cellulose. Under natural conditions, the cotton bolls will increase the dispersal of the seeds.

The plant is a bush native to tropical and subtropical regions around the world, including the Americas, Africa, Egypt and India. The greatest miscellany of wild cotton species is found in Mexico, followed by Australia and Africa.

The fiber is most often spun into yarn and used to make a soft textile. The use of cotton for fabric is known to date to prehistoric times; fragments of cotton fabric dated to the fifth millennium BC have been found in the Indus Valley Civilization. Although cultivated since antiquity, it was the discovered of the cotton gin that lowered the cost of production that led to its use, and it is the most used natural fiber cloth in clothing today.

Current estimates for world production are about 25 million tones or 110 million bales annually, accounting for 2.5% of the world's arable land. China is the world's largest maker of cotton, but most of this is used domestically. The United States has been the largest exporter for many years. In the United States, cotton is usually measured in bales, which measure approximately 0.48 cubic meters (17 cubic feet) and weigh 226.8 kilograms (500 pounds) [1].



Figure-2.1: Cotton fiber shrub

Cotton Fiber – Physical and Chemical Properties of Cotton

Cotton fiber is a cellulosic fiber. At least 96% cellulose in cotton fiber. It has worldwide famous for its variety of use. Cotton fiber is the widely used fibers for making various types of fabric through all over the world. Cotton Fabrics are suitable for wear then the other fibers product. It is suitable to wear in all season in all country.

2.1.1. Physical properties of cotton: Physical properties of Cotton is given below:

1. Length: The cotton fiber length is 0.5" - 2.5"
2. Strength, tenacity is (gm per denier): 3 – 5
3. Dimensional stability is medium.
4. Heat preventive power is also medium.
5. Moisture regain is 7-10% (standard 8.5%).
6. In the cotton fiber Stiffness is 57-60 g/d due to high crystallinity.
7. In the cotton fiber Elasticity is 1.50- 1.58.
8. Resiliency: low
9. Cotton fiber has medium Strength.
10. Cotton fiber density is less than silk.
11. Cotton fiber Color is cream or yellowish like clean white.
12. Specific gravity is 1.52-1.55

2.1.2. Chemical Properties of Cotton Fiber:

The main chemical characteristics of cotton fiber have presented in the following:

1. Action with alkali:

Cotton fibers preventive power is good when it react with alkali. Alkali does not injury cotton fiber.

2. Action with acid:

Strong acid damage cotton fibers. Concentrated sulphuric acid and hydrochloric acid damage cotton fiber. But when it react with weak acid it does not damage.

3. Action with bleaching:

Cotton does not damage in reaction with bleaching agent. Cotton is converted into oxycellulose in strong oxidizing bleaching.

4. Action with organic solvent:

Resistance so dry is possible for cotton fiber.

5. Sunlight preventive power:

Ultraviolet ray converts the cotton into oxycellulose.

6. Mildew preventive power:

Untreated not easy. There is possibility to be affected for cotton fiber.

7. Dye ability:

Cotton fiber affinity to color is good. Direct, reactive, sulphur and vat dyes are used for coloring cotton fiber.

8. Insects preventive power:

Cotton fiber does not affected by moth.

9. Heat:

Conductive ironing temperature is 150°C where decompose is 2400°C and ignition temperature is 390°C [2].

2.2. Weaving

Weaving is a method of textile production in where two clear sets of yarns are interlaced at right angles to form a fabric. Other methods are knitting, crocheting, felting, and braiding or plaiting. The measured from east threads are called the warp and the west threads are the weft or filling. (Weft is an old English word meaning "that which is woven"; compare leave and left.) The method in which these threads are inter-woven affects the characteristics of the cloth. Cloth is generally woven on a shuttle loom, a device that holds the warp threads in place while filling threads are woven through them. A fabric band which meets this definition of cloth (warp threads with a weft thread

winding between) can be made using other methods, including tablet weaving, back strap loom, or other techniques without looms.

The way the warp and filling threads interlace with each other is called the weave. The majority of woven products are created with one of three basic weaves: plain weave, satin weave, or twill. Woven cloth can be plain (in one color or a simple pattern), or can be woven in decorative or artistic design [3].

2.2.1 History of weaving

There are some indications that knitting was already known in the paleolithic period, about 27,000 years ago. Dolní Veststónice found an overwhelming textile impression on the site. According to the discovery, high paleolithic knitwear produces different types of cordes, making applied baskets and sophisticated yarn and plain woven fabrics. Artwork includes imprints in soil and stoneware baking residues.

The oldest known fabrics found in America are the six fine-knitted fabrics and quarazzes found in the Peruvian Guitararo cave. The weeds made from plant fibers are located in 10100 and 9080 BC.

Middle East and Africa

The earliest known neolithic textile product is found in 2013 by a piece of wax cloth that is woven from the grave. The 7121 Catalglu site offers more than 7000 BCE to offer more research comes from the advanced civilization preserved in the residue of peel in Switzerland. Another existing part of Neolithic is found in a site dating to around 5000 BCE. This section is about 9 centimeters in a slave knitting around 12 threads. Flex continued to gain popularity in Egypt (3600 BC) and the Blue Valley of Europe at this time, although the ULT became the primary fiber used in other cultures in the year 2000 BC. Weaving was known in all great civilizations, but the functionality has not established any clear line. The first room to go through the fill is the need for two people to create a shade and a person. Early looms wear a certain length of clothes, but subsequently, after the fall progress, the wounds later cause wounds. Knit was often children or slaves. Wireless shaped form becomes easier to weave.

The Americas

The Indigenous people of the Americas wove textiles of cotton throughout tropical and subtropical America and in the South American Andes of wool from camelids, primarily

domesticated llamas and alpacas. Cotton and the camelids were both domesticated by about 4,000 BCE. American weavers are "credited with independently inventing nearly every non-mechanized technique known today." In the Inca Empire of the Andes, women did most of the weaving using blackstrap looms to make small pieces of cloth and vertical frame and single-heddle looms for larger pieces. Andean textile weavings were of practical, symbolic, religious, and ceremonial importance and used as currency, tribute, and as a determinant of social class and rank. Sixteenth-century Spanish colonists were impressed by both the quality and quantity of textiles produced by the Inca Empire. Some of the techniques and designs are still in use in the 21st century.

The oldest-known weavings in North America come from the Wendover Archaeological Site in Florida. Dating from 4900 to 6500 B.C. and made from plant fibers, the Wendover hunter-gatherers produced "finely crafted" twined and plain weave textiles.

China and East Asia

About 3500 BC, silkworm cocoons are known for silk fabric in China. Deeply woven and colored silk, which shows a well developed crafts, it was found in a Chinese mausoleum in 2700 BC.

Sericulture and silk weaving were spread to Korea in 200 BC in the year 200 AD, and Japan until 300 AD.

Pitt-Traddle loom may be produced in India, although most of the authorities have been invented in China. Pedals heddles have been added to work. Through the medieval period, Persia, Sudan, Egypt, and perhaps even in the Arabian peninsula, appeared, where "operators were sitting beside their feet in the lower lower level of the cage." In 700 AD, horizontal loom and vertical cyclone found in many parts of Asia, Africa and Europe. In Africa, wedded to richer rich and poor clothes. In the middle of the 12th century, Byzantium or Murish came to Spain from Spain, where the process was elevated above the ground in a more important frame.

Medieval Europe

The predominant fiber was wool, followed by linen and nettlecloth for the lower classes. Cotton was introduced to Sicily and Spain in the 9th century. When Sicily was

captured by the Normans, they took the technology to Northern Italy and then the rest of Europe. Silk fabric production was reintroduced towards the end of this period and the more sophisticated silk weaving techniques were applied to the other staples.

The weaver worked at home and marketed his cloth at fairs. Warp-weighted looms were commonplace in Europe before the introduction of horizontal looms in the 10th and 11th centuries. Weaving became an urban craft and to regulate their trade, craftsmen applied to establish a guild. These initially were merchant guilds, but developed into separate trade guilds for each skill. The cloth merchant who was a member of a city's weaver's guild was allowed to sell cloth; he acted as a middleman between the tradesmen weavers and the purchaser. The trade guilds controlled quality and the training needed before an artisan could call himself a weaver.

By the 13th century, an organizational change took place, and a system of putting out was introduced. The cloth merchant purchased the wool and provided it to the weaver, who sold his produce back to the merchant. The merchant controlled the rates of pay and economically dominated the cloth industry. The merchants' prosperity is reflected in the wool towns of eastern England; Norwich, Bury St Edmunds and Lave ham being good examples. Wool was a political issue. The supply of thread has always limited the output of a weaver. About that time, the spindle method of spinning was replaced by the great wheel and soon after the treadle-driven spinning wheel. The loom remained the same but with the increased volume of thread it could be operated continuously.

The 14th century saw considerable flux in population. The 13th century had been a period of relative peace; Europe became overpopulated. Poor weather led to a series of poor harvests and starvation. There was great loss of life in the Hundred Years War. Then in 1346, Europe was struck with the Black Death and the population was reduced by up to a half. Arable land was labor-intensive and sufficient workers no longer could be found. Land prices dropped, and land was sold and put to sheep pasture. Traders from Florence and Bruges bought the wool, then sheep-owning landlords started to weave wool outside the jurisdiction of the city and trade guilds. The weavers started by working in their own homes then production was moved into purpose-built buildings. The working hours and the amount of work were regulated. The putting-out system had been replaced by a factory system.

The migration of the Huguenot Weavers, Calvinists fleeing from religious persecution in mainland Europe, to Britain around the time of 1685 challenged the English weavers of cotton, woollen and worsted cloth, who subsequently learned the Huguenots' superior techniques.

2.2.2. Industrial Revolution

Before the industrial revolution, weaving was a manual artwork and was the main staple of wool. In the Great UI district, a form of factory was introduced, but the coasters were working from home in an extraction system. Wood pieces of that time can be broad or narrow; Wireless wires were too broad so that the shutter could pass the shuttle through the shade so that the wild was necessary for the costly assistant (often an apprentice). In 1732, it was necessary after discovering some of the flying shuttle. Shuttle and picking stick made the weaving process more dynamic. Thus threads or weaving power was a lack of a surplus. In June 1761, cotton can be brought to Manchester, allowing the opening of the bridgewater canal, a rich area of flowing streams that can be used for power plants. Spinning was the first instrument of mechanical (spinning Jenny, spinning mule), and it leads to unlimited threads for finishing.

Edmund Cartwright proposed to produce a knitting machine for the first time, which will work similarly to the advanced cotton-cutting mills in 1784, grabbing bitter from critics, who said that the weaving process has been automatically automated. He built a factory in Don Carter and received a series of patents between 1785 and 1792. In 1788 his brother Major John Cartwright created Revolution Mill (eternal name for the glorious revolution) at Redford. In 1791, he licensed his Loom to Grim Shore brothers of Manchester, but later he burned his knot (possibly a fire incident). In 1809, £ 10,000 was awarded by the Parliament of Edmund Carteite. However, for the success of power-booting, H. Needing improvements by others, including the Harik stockport. After almost 1805, power-weaving was held for just two decades. At that time, there were 250,000 hand weaving in the UK. Textile production was one of the leading sectors of British industrial revolution, but weaving was mechanically comparatively delayed sector. In 1842, the looms with Kantartha and Bullus Lancashire Loom became semi-automatic. Various innovations are used in the process of evaporative factories from the activities of the home-based factories (labor-intensive and man-driven). Reducing a large metal manufacturing industry, Accordington's Howard and Bulf and Tev Dales and Growths to produce looms

like Smallie and Plate Brothers. Most of the electricity weaving is found in knitting sheds in small towns far away in the greater Manchester Chakraborty area than cotton cultivar area. In the previous auditorium, the matches where thorns and weaving were made in seamless buildings became rare. The wool and the worst knit on West Yorkshire and the special Bradford, where there is a large factory, such as the lisers or drums, where all the processes have taken place. Men and women both migrate efficiently, and their new homes in New England take them to places like Povetket and Lowell [4].

2.3. Woven Fabric

Woven fabric is any textile formed by weaving. Woven fabrics are often created on a loom, and made of many threads woven on a warp and a weft. Technically, a woven fabric is any fabric made by interlacing two or more threads at right angles to one another.

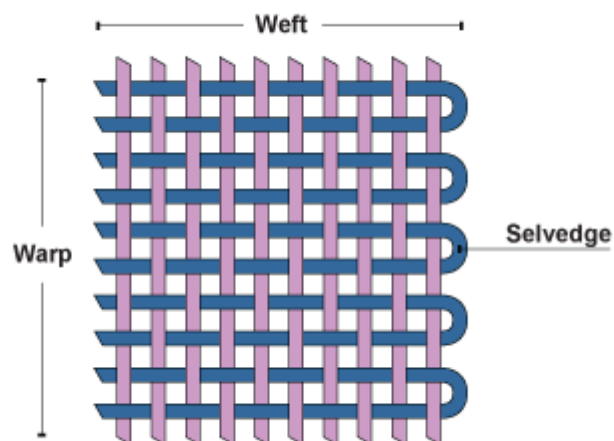


Figure-2.2. Structure of woven fabric

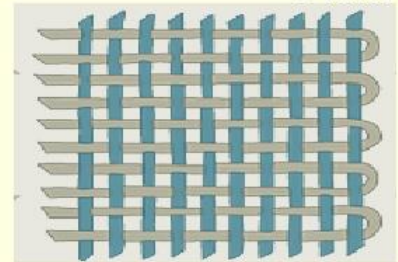
Types of Woven Fabric

Different Types of Weaves

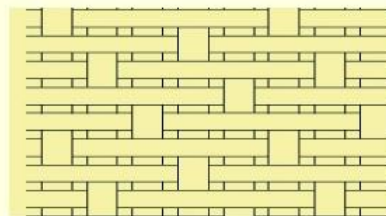
Different arrangement of threads.....

- Plain
- Twill
- Satin
- Sateen
- Diamond
- Honeycomb
- And many more.....

Plain



Satin



Twill

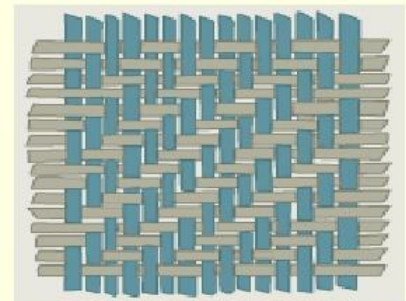


Table 2.1 Distinguish between woven and knits.

o.	Knit Fabric	Woven Fabric
01	Produced by using one set of yarn.	It is produced by using two sets of yarn.
02	It has higher elastic properties.	Elastic properties not more than knit fabric.
03	It needs less labor cost during manufacturing.	Higher labor cost than knit fabric manufacturing.
04	It is comfortable to put on.	It is not more comfortable than knit fabric.
05	It has high extensibility properties.	It has lower extensibility characteristics.
06	Knit fabric has higher recovery characteristics.	Woven fabric has lower recovery properties.
07	It has no dimensional stability.	Woven fabric has dimensional stability.
08	Finishing is advantageous in knit fabric.	In case of woven fabric, finishing is not advantageous.
09	It requires stretch stitches, like zig	It is easy to sew on and feed through a

	zags.	sewing machine.
10	Wrinkle resistant.	Hold a crease well.
11	No seam finish is required.	Requires seam finishing, like serging, to prevent ravel.
12	Edges curl and some knits run.	Edges are prone to ravel.
13	Cool and breathable.	Thick and wind resistant.
14	Most stretch is either in the cross grain or the bias.	Most stretch is always on the bias (diagonal stretch).
15	Mold and fit the contours of the body better.	Look good with pleats and sharp corners.

2.3.1. Advantages and Disadvantages of woven fabric:

Weaving is the primary way fabric is formed. Woven fabrics are formed by weaving threads over and under each other. There are many natural and man-made types of woven fabrics including denim, broadcloth, silk, satin, flannel and twill. Fabric thread can be made from cotton, linen, bamboo, polyester and even rayon.

Cost

As with any industry, time and labor reflect in the costs of the items. Woven fabrics are formed on looms and are made to be sturdy. The fabric cannot be stretched and does not shrink. While this does produce a higher quality clothing, it increases production costs. Other fabrics such as knits are made by machines and can be stretched out using steam machines. This makes the fabric less expensive but also less sturdy. This is why a pair of jeans will easily outlast a T-shirt.

Comfort

Woven fabrics are rigid, making them ideal for thicker work clothes such as jeans and coveralls. This also makes woven fabrics feel less soft than knit fabric. Knit fabrics are flexible and move with the body, stretching and expanding as necessary. The only disadvantage to knit fabrics when it comes to comfort is that they may cling to the wrong places.

WASHING

Most cotton weave fabrics, such as denim, are simple to launder and typically will not shrink or wrinkle. Other woven fabrics such as linen and silk can be laborious with washing, especially if the fabric requires dry cleaning or pressing

Uses

Weaves by far outlast most other fabrics such as knits, and this is why so many heavy duty fabrics are weaves. Examples of woven fabrics include denim, linen, corduroy and

tweed. Knit fabric is comfortable, but not meant for heavy duty use because of the overall stretchiness. Examples of knit fabric includes T-shirt fabric, sweaters, jersey and terrycloth.

2.4. Pigment:

A **pigment** is a material that changes the color of reflected or transmitted light as the result of wavelength-selective absorption. This physical process differs from fluorescence, phosphorescence, and other forms of luminescence, in which a material emits light. Most materials selectively absorb certain wavelengths of light. Materials that humans have chosen and developed for use as pigments usually have special properties that make them useful for coloring other materials. A pigment must have a high tinting strength relative to the materials it colors. It must be stable in solid form at ambient temperatures.

2.4.1 History of pigment dyeing :

Pigments such as strangles and iron oxides are naturally used as color in prehistoric age. Archaeologists have found evidence that the primary people use color for body decoration, such as aesthetic purposes. There are 350,000 to 400,000 year old mint and paint grinding equipment in the cave of Twin rivers near Lusaka in Zambaria.

Before industrial revolution, the color range for industrial and decorative uses was technically limited. Most of the earth's minerals and minerals, or biological dynasty pigments. The pigments from unusual sources such as botanical materials, animal waste, pest, and molluscs are crossed and are operated. Given the range of pigment that was available in some colors, expensive or impossible. Blue and violet came to be associated with royalty due to their annoying.

Biological colors were often difficult to achieve and their production details kept manufacturers confidential. Pigment given to one of several species of Turin Purple M. The use of tearian violet for the use of fabric diy started by the Finnish in about 1200 BC, and with the fall of Constantinople, Greece and Romans continued until 1453 AD. Production of pigment was expensive and complex, and it became associated with the energy and resources of colored items. The Greek historian Theopomas, written in the 4th century BC, said that "Purple color purple colombo [Asia Minor] raised his weight in Qulophone."

Mineral pigment is crossed over long distances. The only way to achieve deep rich blue was by using semi-precious stones, lapis lazuli, creating a pigment known as ultramarine, and the best sources of lapis were remote. Flemish painter John Van Ick, usually working in the 15th century, did not include blue in his paintings. A portrait of the ultramarine commissioned and painted with blue was considered a great luxury. A sponsor wanted blue, they were compulsory to pay extra money. When Van Eyck used lapis, he does not mix with other colors. Instead he applied it in pure form, as a decorated glaze. [8] The restriction of costly replacement pigments, both minerals (Azure, dirt) and biological (blue), are banned in the lapis lazuli. .

In the 16th century the conquest of Spain's new world empire brought new pigments and colors to the public on both sides of the Atlantic. A dye and pigment-made from parasitic insects found in Central and South America- achieved great status and value in Europe. Produced from crop, dried, and crushed cochinalal insect, Carmine fabric diy, food color, body paint, or its strong lake form- almost any type of paint or cosmetic can be used.

According to Diana Magelloni, the Florentine codex has a variety of red color variations. Especially in acetyl (light red) case, the technical analysis of paint reveals multiple layers of pigments, although the pigmentary layers are not visible in the naked eye. Therefore, it proves that the process of applying multiple layers is more significant than the actual color. In addition, the same pigment on top of each other enables the color rendering process to create variations in the intensity of Aztec artists. Pigment A brave application attracts the attention of the viewer which attracts attention and offers visitors a power. Pigment has a weak application less attention to command and less power. It would suggest that Aztec has added pigment intensity with the power and life concept.

From at least 700 AD, the Peruvian residents created cochleal diy for textile, but Europeans have never seen color before. Spanish is now Mexico which attacked the Aztecs empire, they used to quickly use color for new trade opportunities. Carmen became the second most valuable export of the region by Chile. The pigment produced by cochivalal insects gives Catholic Cardinal their vibrant costume and English "reddot" their own uniforms. Until the 18th century, the original source of pigment-insect-teenage was kept secret, when the biological sources were discovered.

Carmen was popular in Europe, blue was the exclusive color of wealth and status. 17th-century Dutch master Johans Vermeer often uses his lapis lazuli, his Caribbean and Indian yellow, his vibrant imagery [5].

2.4.2 The pigment dyeing process is generally a three step process such as:

2. Pigment Exhaustion on the Fabric

Pigments are first mixed with water and a dispersing agent that provides an anionic charge of pigments. This solution is gradually adding dyeing machines. The temperature of the bath increases gradually and the machine lasts 20 minutes for dyeing temperature. The fabric is held to increase the absorption of pigment at a higher temperature.

A typical recipe for this step

- Pigment colorants
- Dispersing agent

2. Binder Application

A binder used to exaggerate pigment dyeing mechanism for fixing pigment color. Binders are usually acrylic polymers with nonionic and cationic nature. It enhances the crock and wash the cleanliness. After the pigment is tired, the binder is fed on the dyeing machine and with time the fabric is tired. Acetic acid bath is added, which gives binder polymerization facilities, then the fabric is a rinse, the dyeing machine is removed and the fabric is extracted.

2.4.3 Physical properties of pigment:

Paints are comprised of two basic components: a binder (or resin) and a colorant (either a dye or pigment). Paint can also include a solvent, which alters its viscosity. The combination of the binder or resin with a solvent is sometimes referred to as the vehicle. In addition, paints can also include a variety of additives, which modify its chemical and

performance properties. In selecting paints and pigments, several properties should be considered, which are listed below:

Lightfastness: The lightfastness of a paint or pigment describes how well it withstands degradation from UV light. Artist paints in tubes are rated on a scale. In the United States, that scale ranges from one (I) to five (V), with I being the most lightfast. The Brits use a different scale from one to eight, with eight being the most lightfast. What did you expect from the British? They still drive on the wrong side of the road.

Heat stability: In outdoor applications, the durability of a pigment is not solely dependent upon its fade resistance in sunlight. The durability of the color is also affected to a large extent on how it withstands elevated temperatures

Toxicity: Many of the traditional pigments were highly toxic. While most of these pigments have been replaced by safer and less expensive synthetic pigments, some of the original pigments are still available for conservators and the purists. One of the best sources for natural and historical pigments and paints is the company, Natural Pigments.

Opacity or Hiding Power: Hiding power or opacity of a paint or pigment is its ability to hide the surface that you are painting. Selection of a pigment can be based on either its hiding power or its translucency.

Color Temperature: Can show the color of different colored pigments of the same color. This is one of the many different choices for the same color. A color cooler variety of cool and colorless blue and green vegetables tend to tend. The warm color range yellows show a warm throw of red. Even the difference between black and white is not black and white. For example, Ivory Black Carbon uses black pigment that is a much more cool color than black on Mars, which is iron oxide pigment. Flake White, which is a yellow cast, brighter than titanium white or cool blue white zinc much warmer.

Tinting Strength: The tinting power describes the ability of the pigment to change the color of another color. In part, tinting energy results from pigment concentration in his car. The effect of tinting power affects the physical properties of the pigments, such as its clarity such as how to absorb a pigment fixed light wavelength and reflect others. Keeping particle size and spreading a role. The following lines can display dramatically different characteristics for the same color as two different alphabets. You can compare

the tinting energy of two paint by combining equal amount of color to equal quantities of titanium white. It cannot be very scientific compared to using a laboratory instrument, but it should be done for field painters.

Chemical Resistance: The colors of a pigment can not only fade, but can change its color. Exposure to acid and alkaline, heat and air pollution can actually make some pigment dark. In response to oxidation or other elements in the atmosphere, some pins become dark. When I was working for a Vinem Filmmaker, I investigated the failure of a product, in which a bright red film was darkened in a barged color. This color change may be affected for any reason, including heat and oxidation [6].

General recipe for pigment dyeing:

Pigment (blue)	-	10g/l
Binder	-	40g/l
Thickener	-	2g/l
Di Ammonium phosphate	-	5g/l
Sample wt.	-	90 gm
PH	-	4.5
Temp.	-	Normal
Curing Temp.	-	120
Time	-	3 minute

2.4.4 Dyeing Process

Step: 1 Scouring (Half bleach) the garments through caustic soda then rinse the garment with the normal water

Step: 2 Take new water and make it soft with the acidic acid.

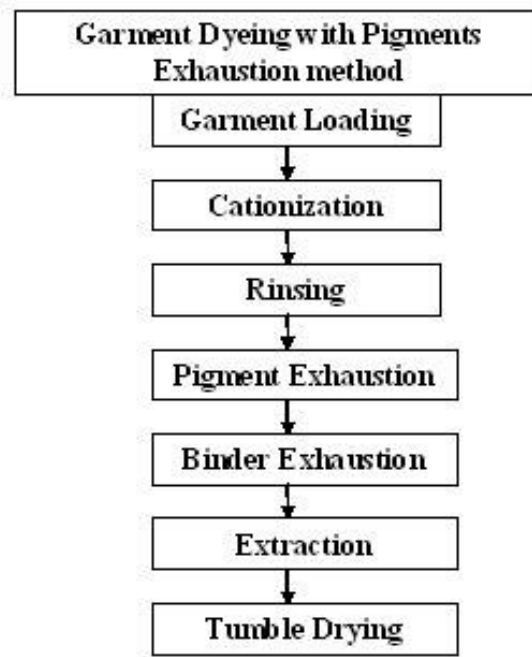
Step: 3 Apply pigment dyes with the dyeing recipe ratio.

Step: 4 After the wet process, tumble dry the garment for curing the dyeing.

Step: 5 After the dry process, put the garment in to the garment dyeing machine (winch) for the bio-polish enzyme to remove the unfix dyes and developing the frosting look.

Step: 6 After the washing process, tumbles dry the garment

2.4.5 Dyeing Process Flow Diagram



A Process flow diagram for pigment Garment dyeing process

2.4.6 Advantages of Pigment Dyeing

1. It's applicable to a wide range of textiles and wide gamut of colors available. Some brilliant fluorescent pigments are available for special applications and fashion items.
2. The process of pigment dyeing can also be relatively cheap.
3. The process chemicals are less toxic, environmentally friendly and least polluting.
4. The color fades with the repeated use, just like denims.

Limitations of Pigment Dyeing

1. Color fading could be a problem if not desired, and can only be kept intact with further chemical treatments.
2. The abrasion resistance and hand could be unsatisfactory depending upon the pigment, binder and softener used.

Dark and deep shades are better produced with other dyestuffs rather than pigments.

2.5. Padding Mangle

ON-THE-SPOT SQUEEZE DYEING &/OR RESIN FINISHING TESTS

Conventional squeeze dyeing &/or resin finishing formulae have been applied directly by mill personnel through their many years' experience however, due to mass production schedules, they have not enough time to prepare such indispensable R&D formulae resulting in a long term bottleneck, increase in production costs and fair quality control.

In view of the above fact, we now offer our Heavy-Duty Padding Mangle to suit all mill requirements; they are available in either Vertical or Horizontal Version.

2.5.1 Applications

1. Independent setting of pick up percentage equals to those from bulk production, precise Pad-Dyeing or Resin Finishing formulae can be obtained.
2. Used in conjunction with our Mini-Dryer or Mini-Tender, test samples showing precise test results and correct hand feel are obtained and offered to customers.
3. This machine can be used for concentration selection of dyestuff and finishing auxiliaries, or to evaluate their quality, hence is a suitable appliance for dye houses, auxiliary, pigment and other chemical manufacturing plants.
4. To perform water repellent, flame retardation and/or coating tests as required.
5. To perform and evaluate the degree of color change and to prevent that it happens again during resin finishing and/or drying processes after change and to further avoid it happened during resin finishing and/or drying processes after dyeing processes.

2.5.2 Special Features

1. Padding roller pressure adjustable independently on RHS/LHS thanks to precise pneumatically controlled diaphragm valves, permanently constant nip pressure are absolute at all times.
2. Currently padding rollers are of 70° shore hardness (55° optional), pick up percentage obtained between 25% to 110% therefore can suit a wide range of fabric varieties. (See attached drawing).
3. Once setting of the padding nip pressure has been done, no other re-adjustment will be needed.
4. Safety devices include a safety rod plus an emergency touch ON/OFF button and a knee pedal which automatically stops the machine as well as releasing both padding rollers.
5. Robust machine rack included, no need to prepare other frame structure.
6. Besides the main rack, remaining parts of machine frame are all made of stainless steel to protect the unit from chemical corrosion.

2.5.3 Machine Specification

- 1) Roller diameter 125mm by 450mm wide.
- 2) Driven by ¼ hp electric motor with speed reducer.
- 3) 3 ton nip pressure at 5 kg/cm² air supply with pressure resistance pneumatic diaphragm valves.
- 4) Fix revolving speed of 10-12 rpm.
- 5) 2 pressure gauges.
- 6) 2 pressure regulating valves LHS/RHS.
- 7) 1 pair of padding roller produced of N.B.R rubber material of 70o shore hardness.[7]

2.5.4 Dyeing Method

Padding operation consists of two necessary steps: thorough penetration through the immersion of drying fabric in a die agent containing a wet agent. Then put the wet fabric in the rollers and replace them with colorful colors, as well as the extra wine behind

sloping fabric surface to reveal the pad trough. The pad fabric is taken from the form or from the bracket and is fed on the padding machine on a set of guide rollers. The fabric is diagonal and folding instructions are straight. It is necessary to attach and cut pieces of both sides of batch .Padded fabric should be padded, adhesive fly, waste, oily, flat, free of crease and open-out with cell-play. The speed of the fabric running and the length of the dyeing wine fabric continues for the shadows to be collected, during padding. There are three main types of automatic level control:

1. Float switches: these are reliable and are unaffected by foam but they are relatively bulky
2. Conductivity probes: these are small and neat but foaming of the pad liquor adversely affects their performance
3. Differential pressure detectors: those with a hollow tube projecting downwards from the liquor surface are difficult to clean and the preferred type is that with a closed diaphragm set in the base of the vessel.
4. The control of pad liquor temperature is highly desirable to achieve consistent results.[8]

CHAPTER-3

EXPERIMENTAL DETAILS

CHAPTER-3

EXPERIMENTAL DETAILS

3.1 Materials

- 1) 100% cotton woven fabric (Plain).

Table 3.1: Sample Specification

Sample no	Fabric type	GSM	WPI	CPI
01	Cotton Woven Fabric	90	66	94

Chemicals used in pigment dyeing:

- 1) Fixer
- 2) Binder
- 3) Pigment

Table 3.2: Function of chemical

Chemical	Function
Pigment	Main substances to produce color.
Binder	Binder is the material that holds the pigment together and gives a finish that sticks well to the surface.
Thickener	It helps the pigment particle to attach with fabric.

3.2. Methods

Method of pigment dyeing

Finally, we collect the sample and a bath. Where chemicals are mixed properly. When we take chemicals the amount of chemicals were taken on the weight of sample and with the help of liquor ratio.

However, we maintain pH, time and pressure during dyeing of fabric sample. The above maintain parameter mentioned below in table 3.3.

Table 3.3. Pigment dyeing recipe

Particular	Recipe
Pigment (yellow)	10 g/l
Binder	40 g/l
Thickener	5 g/l
Di-sodium hydrogen phosphate	5g/l
Sample weight	90 gm
pH	4.5
Temperature	Room temperature
Curing temperature	140°C
Time	3 minute

Table3.4. Apparatus used

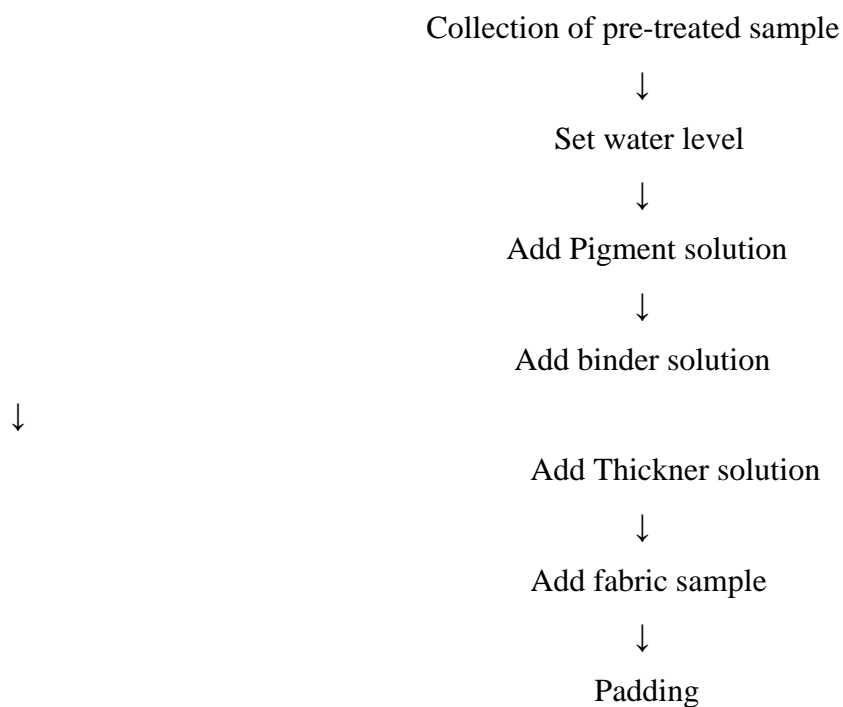
Name	Function
Electric Balance	Used to measure weight
Scissor	Used to cut the sample
GSM cutter	Used to cut the fabric 100sqm
Scale	Used to measure the length
Biker	Used to mixing the chemicals

Glass rod	Used to stirring the chemicals
pH meter	Used to check pH



Figure: 3.1. Padding mangle machine

Process Sequence :



↓
Curing

Rubbing test

- Rubbing cloth should adopt cotton semi-finished fabrics which have been desized, scoured, bleached and do not contain any finishing agent.
- Tested sample is fixed on bottom floor of tester by clamping device, and its length direction is in accordance with movement direction of tester.
- Dry rubbing cloth is fixed on friction head of tester, and the warp direction of it is in accordance with movement direction of friction head.
- Press Start Switch, reciprocating rub for 10 times in 10s (reciprocating movement is 100mm, vertical pressure is 9N), then take the dry rubbing cloth off.
- Taking another rubbing cloth, and rolling it on rolling fluid device after soaked in cool water, to make moisture content controlled in 95% to 105%.
- To do the above operation of dry rubbing cloth repeatedly. When rubbing is finished, dry it at room temperature.
- Using gray cards evaluating staining to measure the staining fastness of above dry and wet rubbing cloths.

Color Fastness to Wash test

Sample: Natural dyed sample of 10X4 cm².

Dyes & Chemicals:

Table 3.5: List of dyes and chemicals

Dyes & Chemicals	Function
Detergent	To remove dirt, dust & excessive color.
Sodium Perborate	It available as an active oxidant in detergent.

Table 3.6: Recipe of Washing

SL	Process Parameter	Unit	Dossing	Stock Solution
01	Detergent	g/L	4	1%

02	Sodium Perborate	g/L	1	1%
03	M:L	-----	1:50	-----
04	Temperature	°C	40	-----

Process Flow Chart:

Sample & Multi-fiber conditioned as lab standard (20±2)°C temperature and relative humidity (65±2).



Take multi-fiber & sample of 10X6 cm².



Sewing both multi-fiber and test specimen together.



Wash sewed specimen as per recipe.

SAMPLE ATTACHMENT

Sample after dyeing	5 Mpa (3 Times)	
	5 Mpa (2 Times)	
	5 Mpa (1 Times)	
	3 Mpa (3Times)	
	3 Mpa (2 Times)	
	3 Mpa (1 Times)	
	1 Mpa (3 Times)	
	1 Mpa (2 times)	
	1 Mpa (1 time)	

Sample before dyeing	
-------------------------------------	--

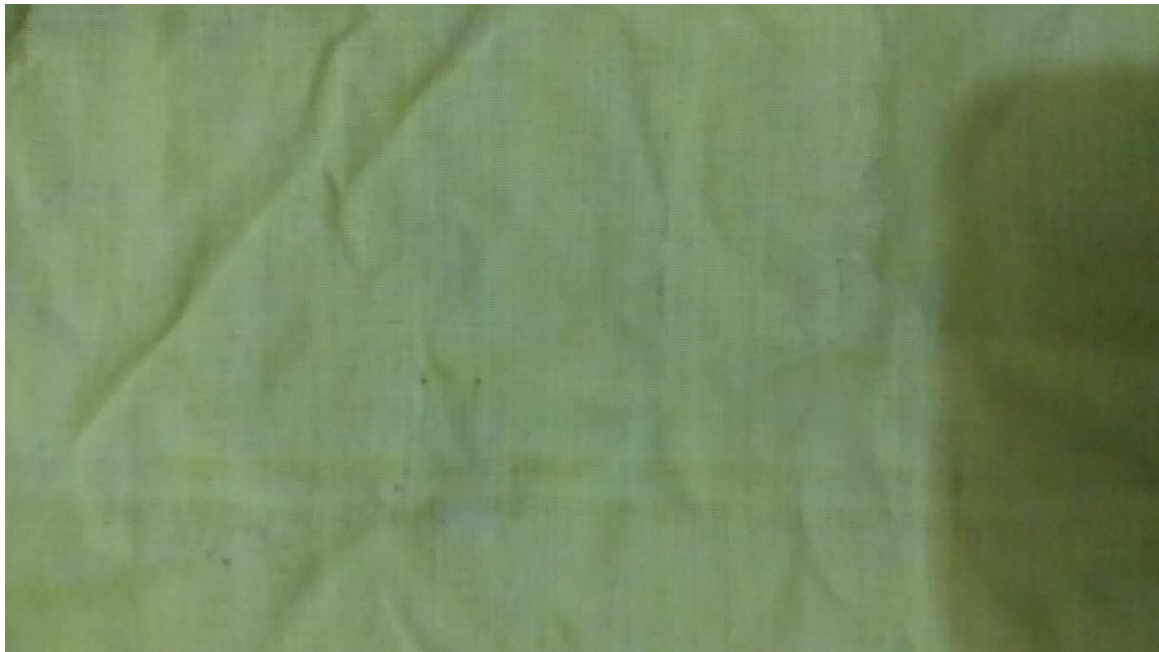
CHAPTER-04
DISCUSSION OF RESULTS

CHAPTER-04

DISCUSSION OF RESULTS

4.1 Color fastness to washing of pigment dyed fabric at different pressure.

After Pigment dyeing process Wash Fastness of color change of fabric in different pressure of padding machine value were recorded in the appendix-A4. The Wash Fastness of color change of fabric after pigment dyeing process in different pressure of padding mangle machine has been used to draw the following figure 4.4



After applying 1Mpa pressure (1 time) wash fastness is 3 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	3
Color change in shade staining in Cotton	3
Color change in shade staining in Polyamide	3
Color change in shade staining in Polyester	3
Color change in shade staining in Acrylic	3
Color change in shade staining in wool	3



After applying 1Mpa pressure (2 times) wash fastness is 3 out of 5

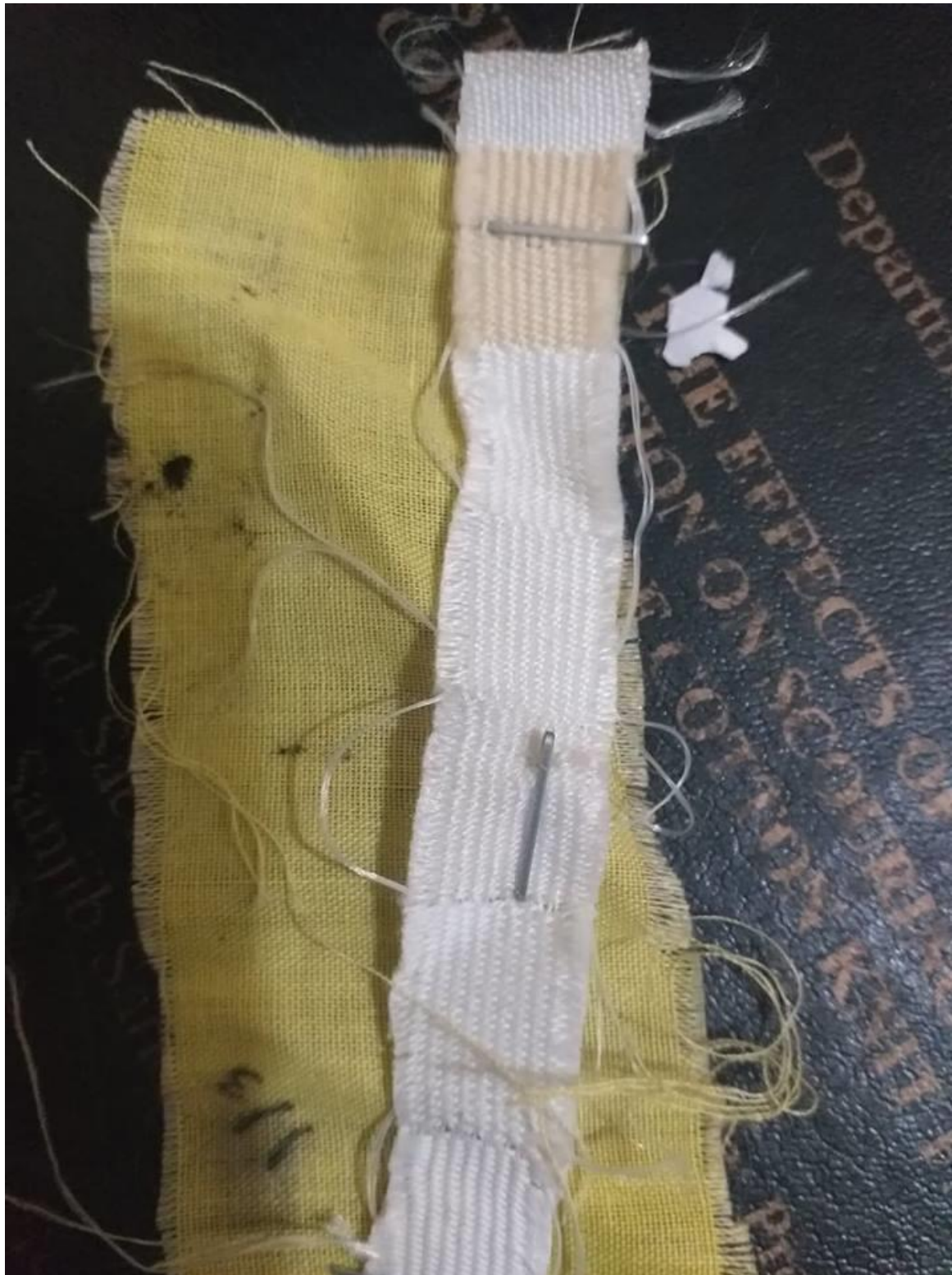


Test Description	Result in Grade
Color change in shade staining in Acetate	3
Color change in shade staining in Cotton	3

Color change in shade staining in Polyamide	3
Color change in shade staining in Polyester	3
Color change in shade staining in Acrylic	3
Color change in shade staining in wool	3

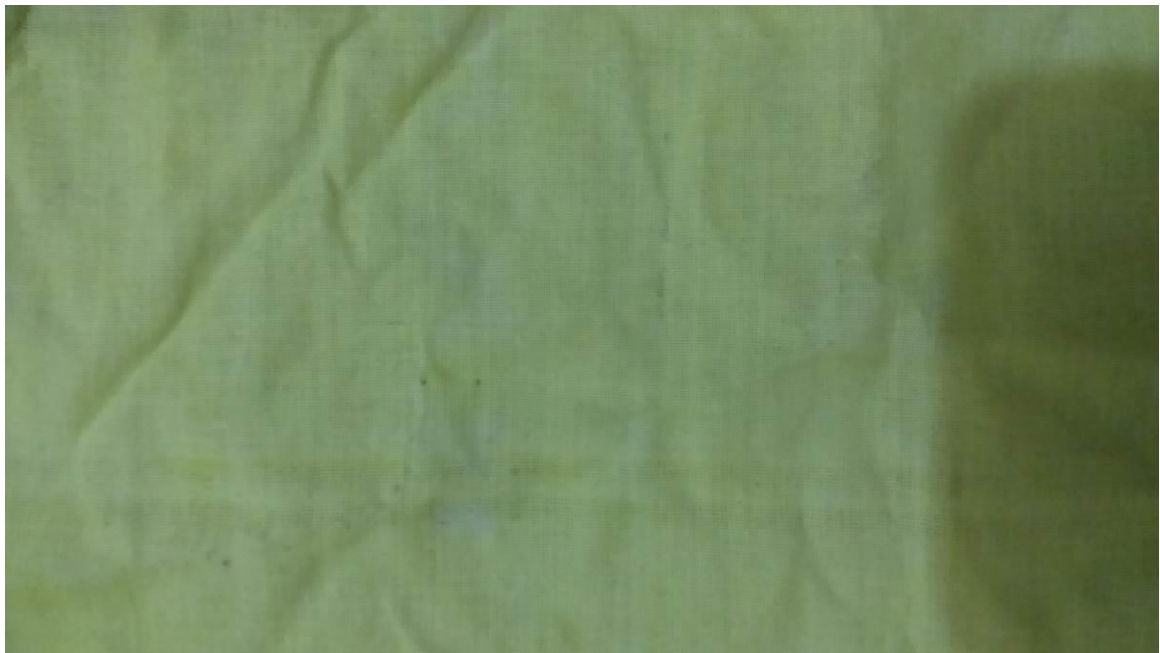


After applying 1Mpa pressure (3 times) wash fastness is 3/5 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	3/5
Color change in shade staining in Cotton	3/5

Color change in shade staining in Polyamide	3/5
Color change in shade staining in Polyester	3/5
Color change in shade staining in Acrylic	3/5
Color change in shade staining in wool	3/5



After applying 3Mpa pressure (2 time) wash fastness is 3/5 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	3/5
Color change in shade staining in Cotton	3/5
Color change in shade staining in Polyamide	3/5
Color change in shade staining in Polyester	3/5
Color change in shade staining in Acrylic	3/5
Color change in shade staining in wool	3/5



After applying 3Mpa pressure (2 times) wash fastness is 4 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	4

Color change in shade staining in Cotton	4
Color change in shade staining in Polyamide	4
Color change in shade staining in Polyester	4
Color change in shade staining in Acrylic	4
Color change in shade staining in wool	4



After applying 3Mpa pressure (3 times) wash fastness is 4 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	4
Color change in shade staining in Cotton	4

Color change in shade staining in Polyamide	4
Color change in shade staining in Polyester	4
Color change in shade staining in Acrylic	4
Color change in shade staining in wool	4



After applying 5Mpa pressure (1 time) wash fastness is 4 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	4
Color change in shade staining in Cotton	4

Color change in shade staining in Polyamide	4
Color change in shade staining in Polyester	4
Color change in shade staining in Acrylic	4
Color change in shade staining in wool	4



After applying 5Mpa pressure (2 times) wash fastness is 4/5 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	4/5
Color change in shade staining in Cotton	4/5
Color change in shade staining in Polyamide	4/5
Color change in shade staining in Polyester	4/5
Color change in shade staining in Acrylic	4/5
Color change in shade staining in wool	4/5



After applying 5Mpa pressure (3 times) wash fastness is 4/5 out of 5



Test Description	Result in Grade
Color change in shade staining in Acetate	4/5

Color change in shade staining in Cotton	4/5
Color change in shade staining in Polyamide	4/5
Color change in shade staining in Polyester	4/5
Color change in shade staining in Acrylic	4/5
Color change in shade staining in wool	4/5

4.2 Staining Change to washing of pigment dyed fabric sample

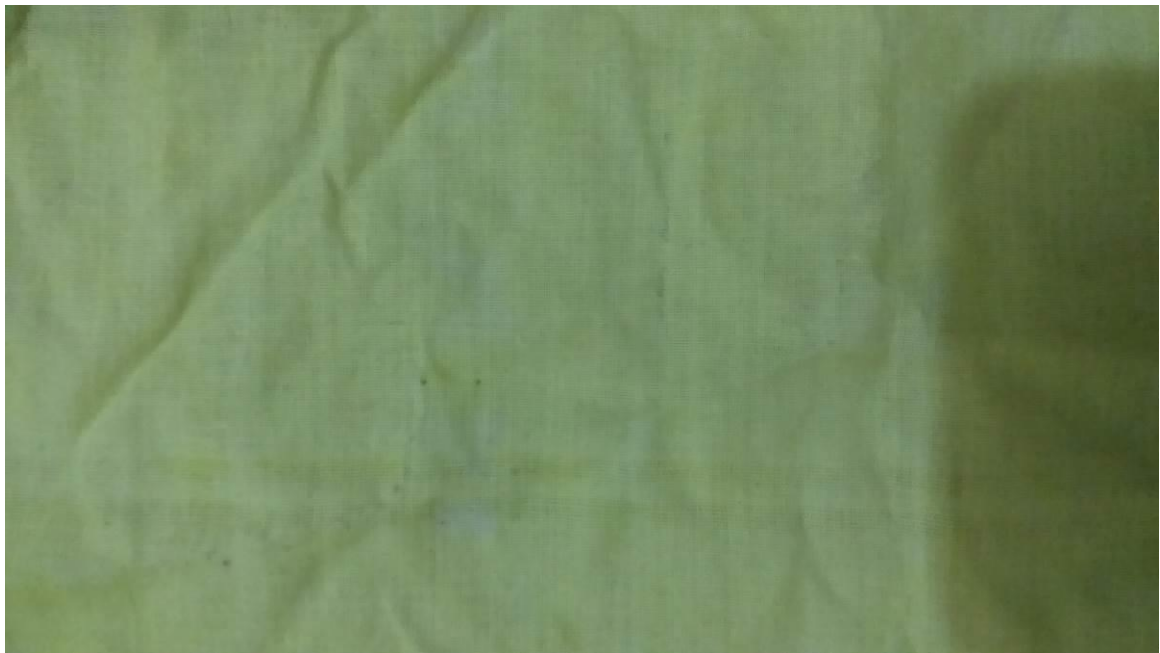
After Pigment dyeing process Wash Fastness of staining change of fabric in different pressure of padding machine value were recorded in the appendix-A4. The Wash Fastness of staining change of fabric after pigment dyeing process in different pressure of padding mangle machine has been used to draw the following figure 4.5



After applying 1Mpa pressure (1 time) wash fastness is 3 out of 5



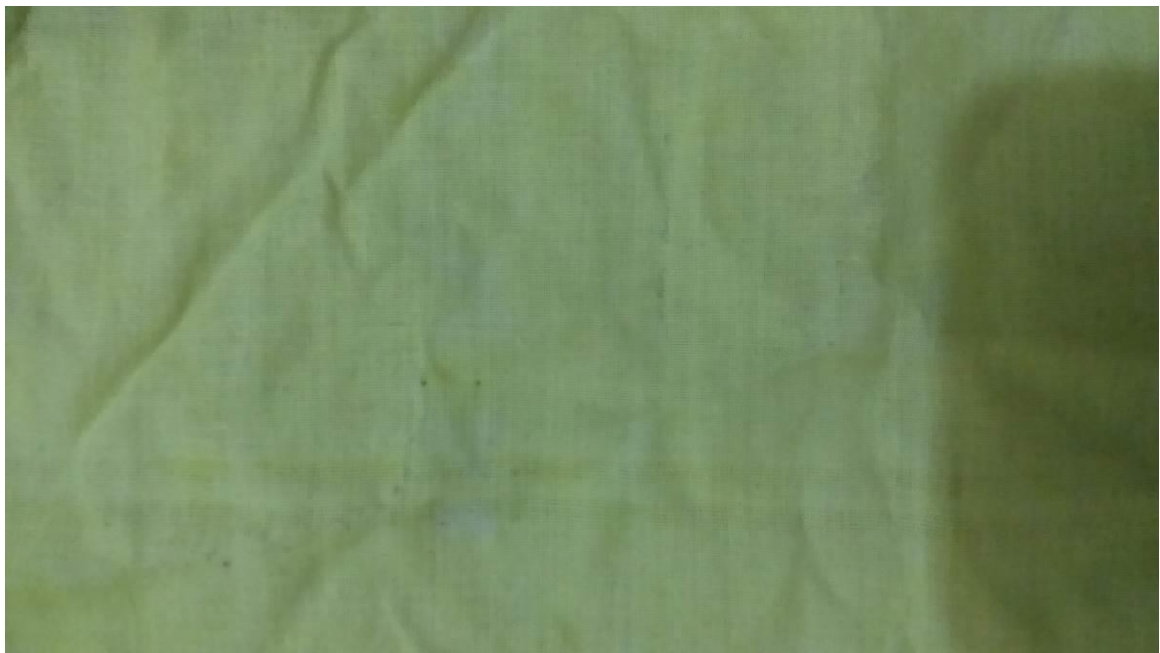
After applying 1Mpa pressure (2 times) wash fastness is 3 out of 5



After applying 1Mpa pressure (3 times) wash fastness is 3/5 out of 5



After applying 3Mpa pressure (1 time) wash fastness is 3/5 out of 5



After applying 3Mpa pressure (2 times) wash fastness is 3/5 out of 5



After applying 3Mpa pressure (3 times) wash fastness is 4 out of 5



After applying 5Mpa pressure (1 time) wash fastness is 4 out of 5



After applying 5Mpa pressure (2 times) wash fastness is 4/5 out of 5



After applying 5Mpa pressure (3 times) wash fastness is 4/5 out of 5



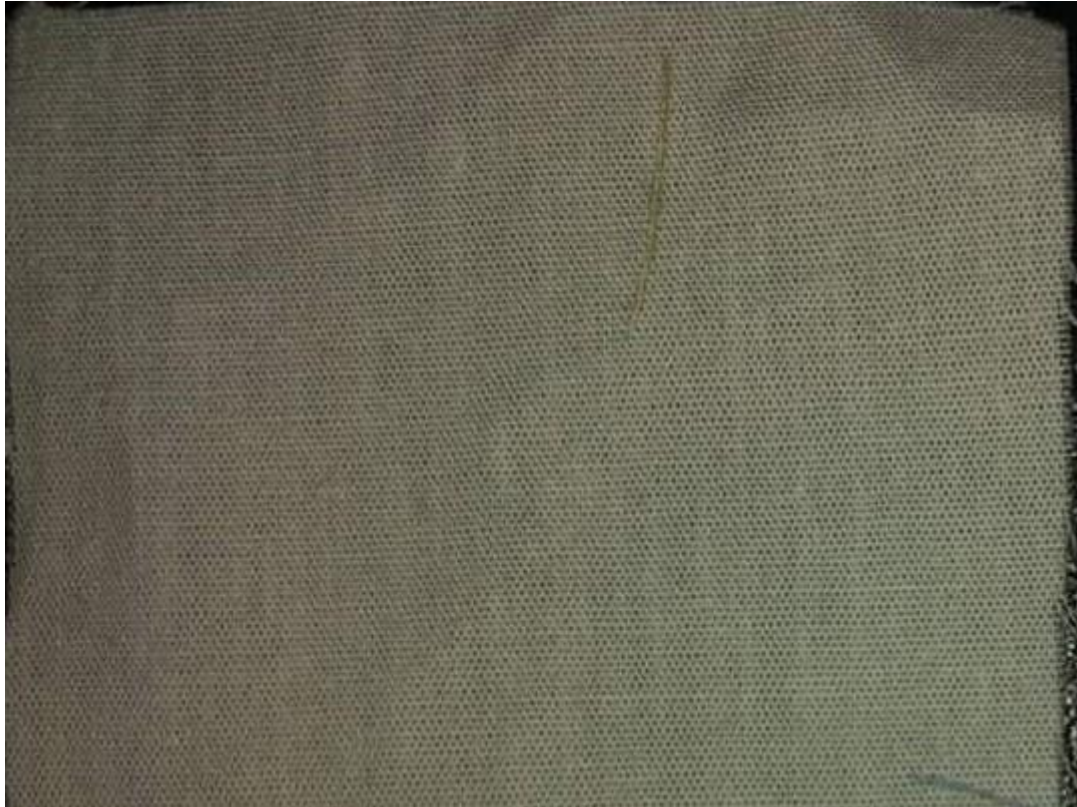
After applying 1Mpa pressure (2 time) wash fastness is 3 out of 5

4.3 Staining Change to rubbing for dry sample of pigment dyed fabric at different pressure.

After Pigment dyeing process Rubbing Fastness of staining for dry change of fabric in different pressure of padding machine value were recorded in the appendix-A5. The Rubbing Fastness of staining for dry change of fabric after pigment dyeing process in different pressure of padding mangle machine has been used to draw the following figure.



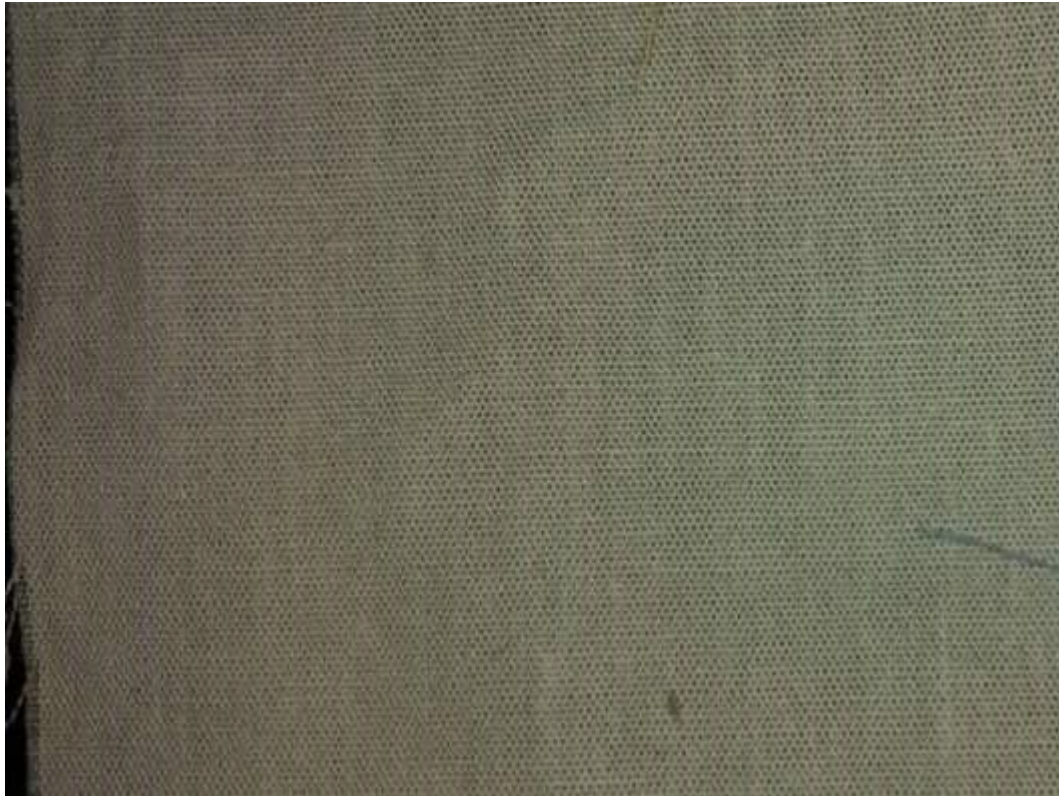
After applying 1Mpa pressure (1 time) rubbing fastness is 3/5 out of 5



After applying 1Mpa pressure (1 time) rubbing fastness is 3/5 out of 5



After applying 1Mpa pressure (2 times) rubbing fastness is 3/5 out of 5



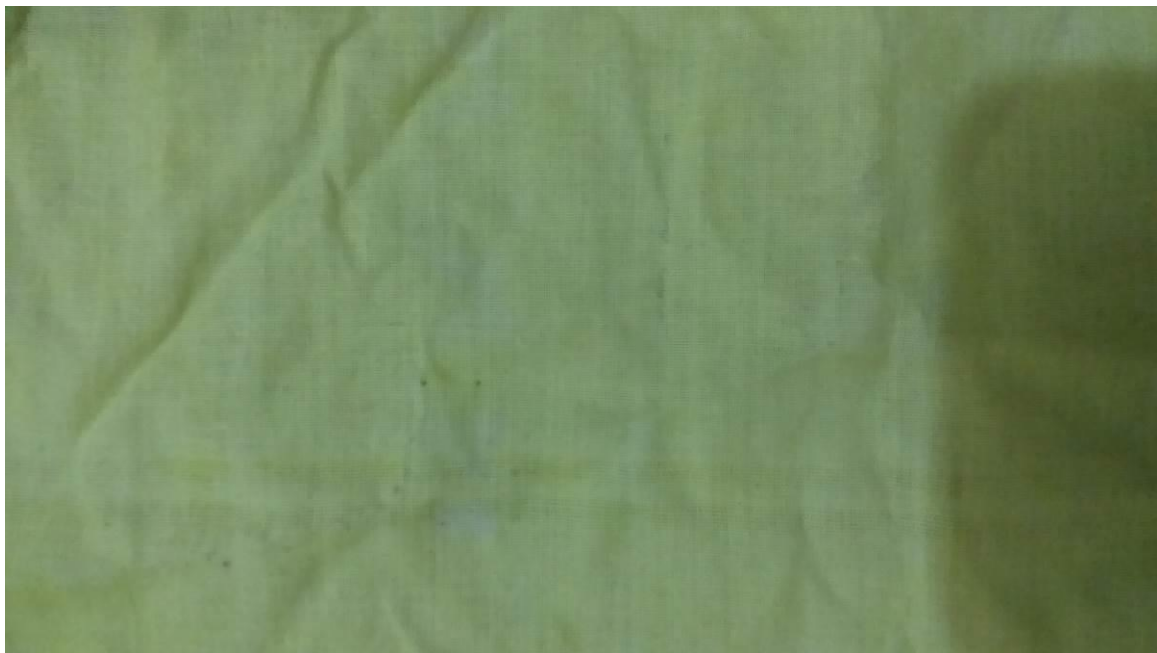
After applying 1Mpa pressure (1 time) rubbing fastness is 3/5 out of 5



After applying 1Mpa pressure (3 times) rubbing fastness is 4 out of 5



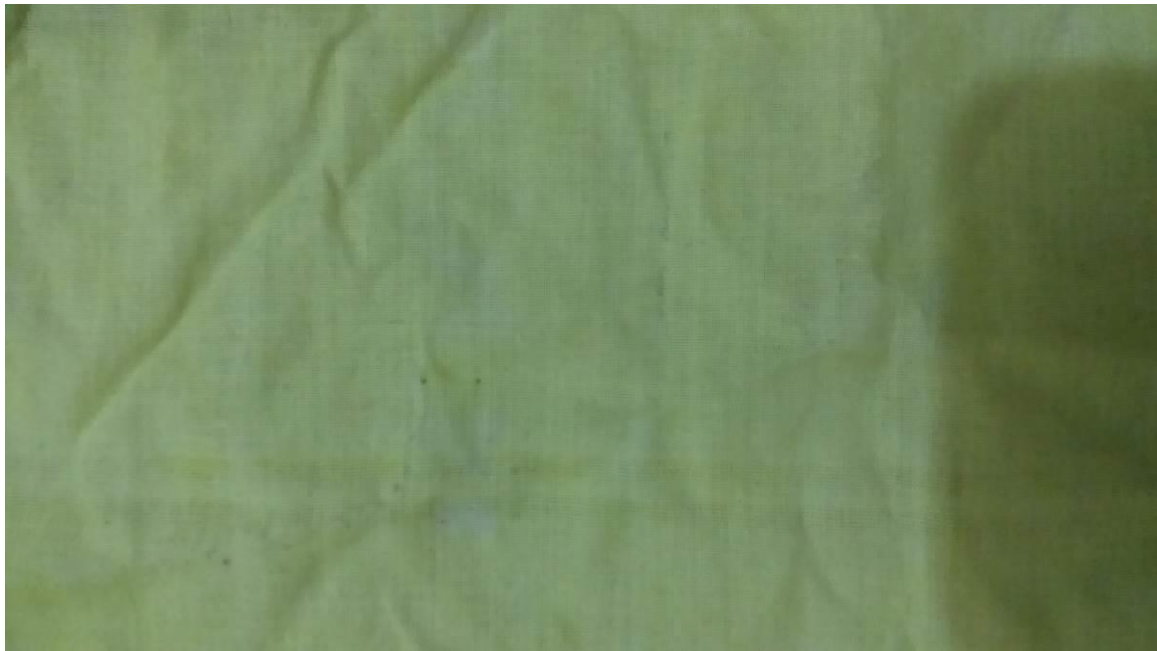
After applying 1Mpa pressure (3 times) rubbing fastness is 4 out of 5



After applying 3Mpa pressure (1 time) rubbing fastness is 3/5 out of 5



After applying 3Mpa pressure (1 time) rubbing fastness is 3/5 out of 5



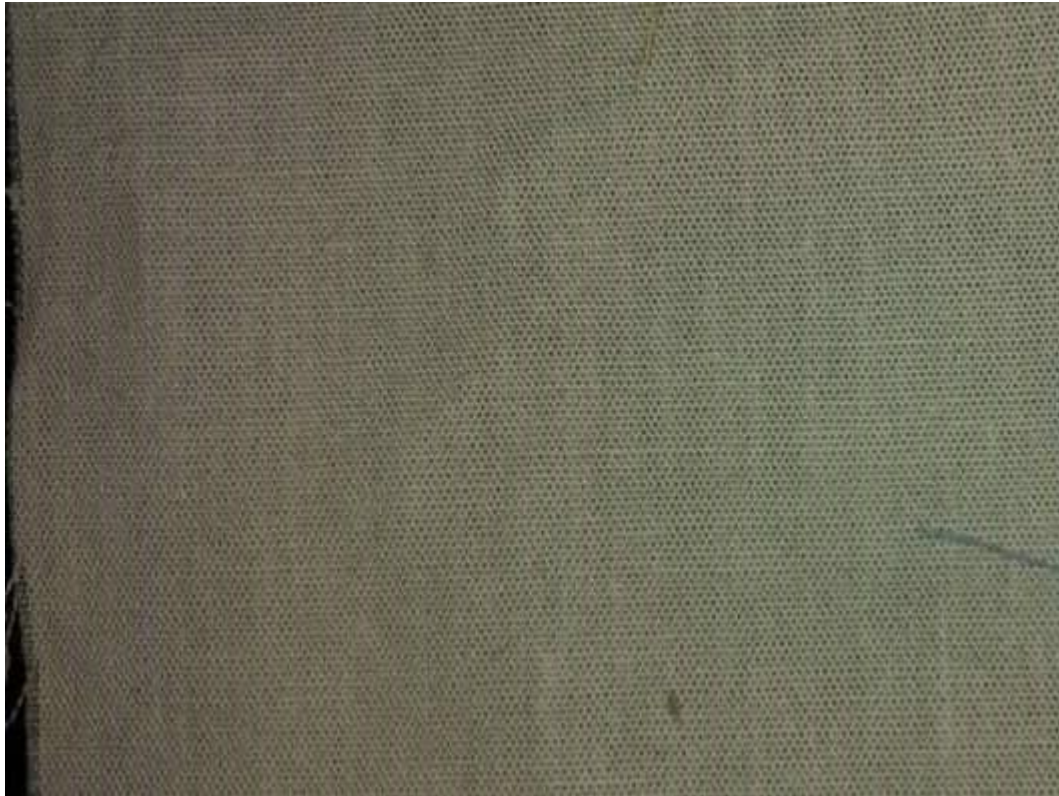
After applying 3Mpa pressure (2 times) rubbing fastness is 4 out of 5



After applying 3Mpa pressure (2 times) rubbing fastness is 4 out of 5



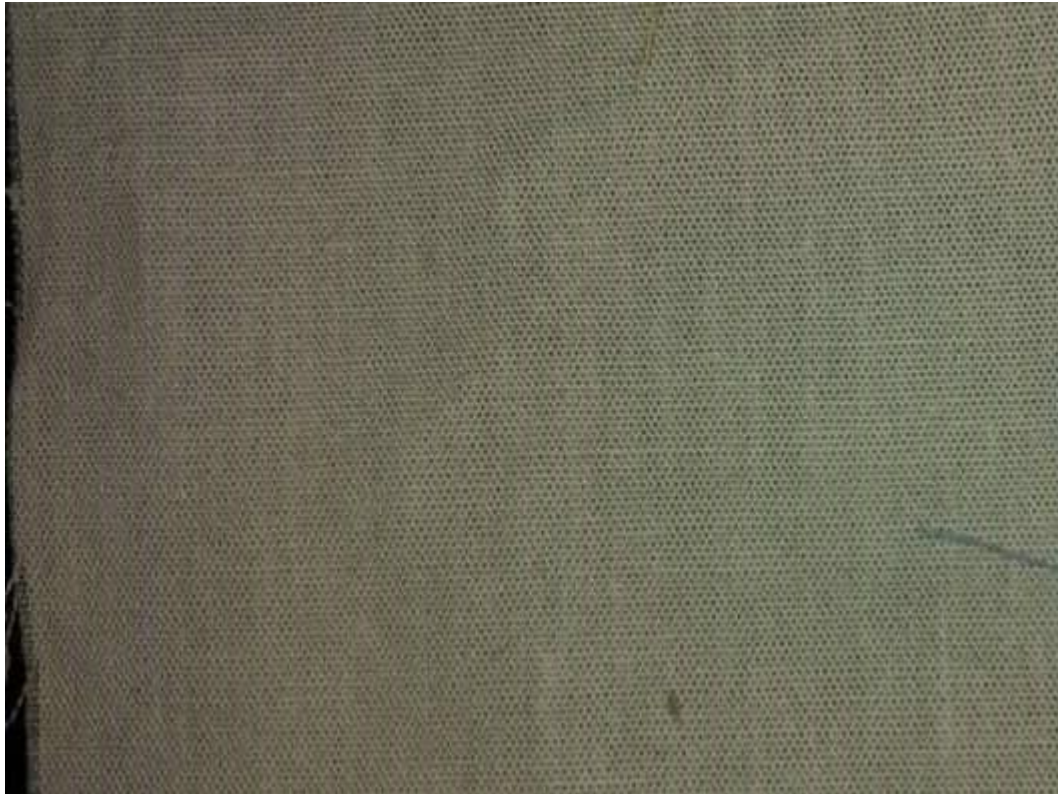
After applying 3Mpa pressure (3 times) rubbing fastness is 4 out of 5



After applying 3Mpa pressure (3 times) rubbing fastness is 4 out of 5



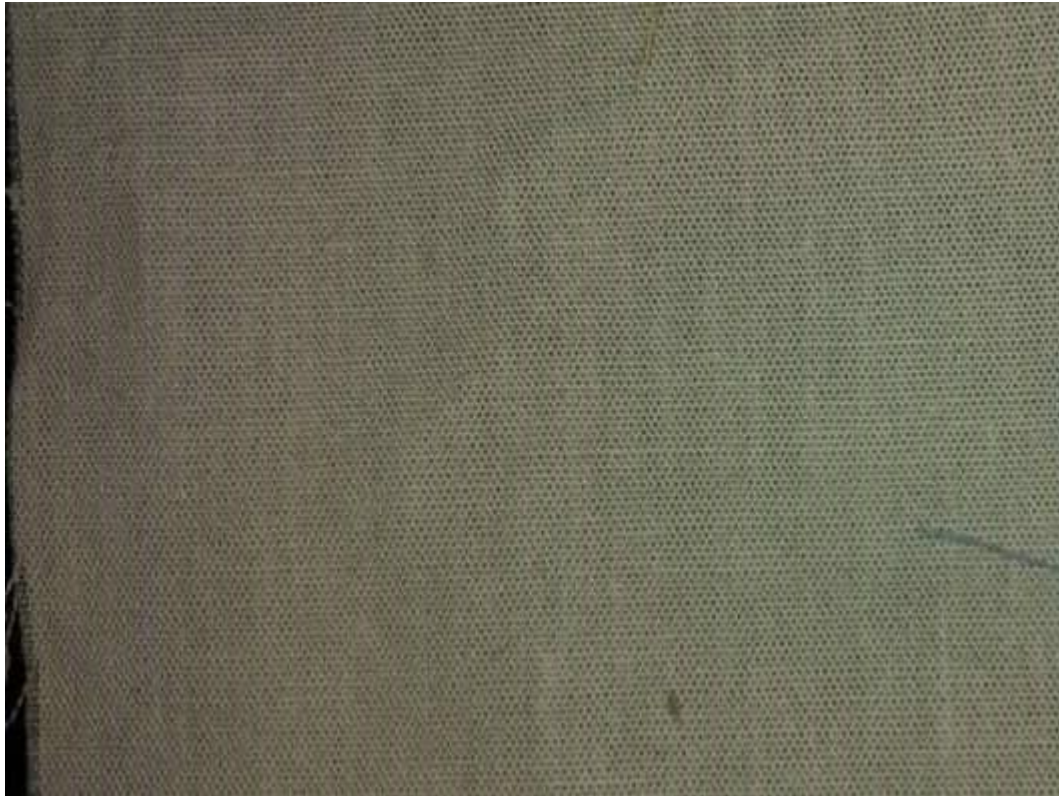
After applying 5Mpa pressure (1 time) rubbing fastness is 4/5 out of 5



After applying 5Mpa pressure (1 time) rubbing fastness is 4/5 out of 5



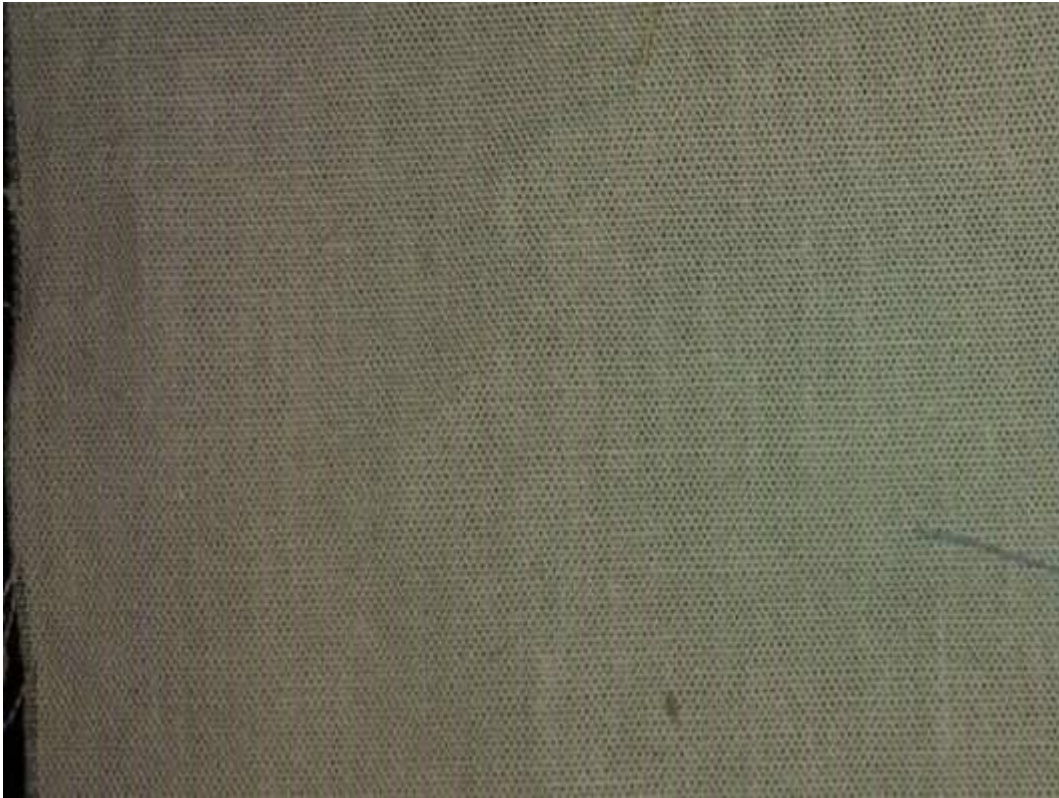
After applying 5Mpa pressure (2 times) rubbing fastness is 4 out of 5



After applying 5Mpa pressure (2 times) rubbing fastness is 4 out of 5



After applying 5Mpa pressure (3 times) rubbing fastness is 4/5



After applying 5Mpa pressure (3 times) rubbing fastness is 4/5

4.4. Staining Change to rubbing for wet sample of pigment dyed fabric at different pressure.

After Pigment dyeing process Rubbing Fastness of staining for wet change of fabric in different pressure of padding machine value were recorded in the appendix-A5. The Rubbing Fastness of staining for wet change of fabric after pigment dyeing process in different pressure of padding mangle machine has been used to draw the following figure.



After applying 1Mpa pressure (1 time) rubbing fastness is 2 out of 5



After applying 1Mpa pressure (1 time) rubbing fastness is 2 out of 5



After applying 1Mpa pressure (2 times) rubbing fastness is 2 out of 5



After applying 1Mpa pressure (2 times) rubbing fastness is 2 out of 5



After applying 1Mpa pressure (3 times) rubbing fastness is 2/5 out of 5



After applying 1Mpa pressure (3 times) rubbing fastness is 2/5 out of 5



After applying 3Mpa pressure (1 time) rubbing fastness is 3 out of 5



After applying 3Mpa pressure (1 time) rubbing fastness is 3 out of 5



After applying 3Mpa pressure (2 times) rubbing fastness is 2/5 out of 5



After applying 3Mpa pressure (2 times) rubbing fastness is 2/5 out of 5



After applying 3Mpa pressure (3 times) rubbing fastness is 3 out of 5



After applying 3Mpa pressure (3 times) rubbing fastness is 3 out of 5



After applying 5Mpa pressure (1 time) rubbing fastness is 3 out of 5



After applying 5Mpa pressure (1 time) rubbing fastness is 3 out of 5



After applying 5Mpa pressure (2 times) rubbing fastness is 3/5 out of 5



After applying 5Mpa pressure (2 times) rubbing fastness is 3/5 out of 5



After applying 5Mpa pressure (3 times) rubbing fastness is 3/5 out of 5



After applying 5Mpa pressure (3 times) rubbing fastness is 3/5 out of 5

CHAPTER-5

CONCLUSION

CHAPTER-5

CONCLUSION

- ✚ After 1Mpa pressure and 1 time padding Wash Fastness of color and staining is lower before dyeing sample. When we apply 5 Mpa pressure and padding 3 times then the Wash Fastness of color and staining is more lower the 1 Mpa pressure.
- ✚ After 1 Mpa pressure and 1 time padding Rubbing Fastness of staining for both dry and wet fabric is lower before dyeing sample. When we apply 5 Mpa pressure and padding 3 times then the Rubbing Fastness of staining for both dry and wet fabric is more lower the 1 Mpa pressure.

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APPENDIX

Table A1. Color fastness to washing of pigment dyed fabric at different pressure.

Sample Name	Padding pressure	No. of padding	Change in Color	Staining
Plain	1 MPa	1 time	3	3
		2 times	3	3
		3 times	3.5	3.5
	3 MPa	1 time	3.5	3.5
		2 times	4	3.5
		3 times	4	4
	5 Mpa	1 time	4	4
		2 times	4.5	4.5
		3 times	4.5	4.5

Table A2. Staining Change to rubbing of pigment dyed fabric at different pressure.

Sample Name	Padding pressure	No. of padding	Staining at dry condition	Staining at wet condition
	1 MPa	1 time	3.5	2
		2 times	3.5	2
		3 times	4	2.5

Plain	3 MPa	1 time	3.5	3
		2 times	4	2.5
		3 times	4	3
	5 MPa	1 time	4.5	3
		2 times	4	3.5
		3 times	4.5	3.5