Faculty of Engineering
Department of Textile Engineering

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

Thesis Title: Study on material realization and waste generation in single jersey circular knitting machine.

Submitted By

Name	ID
G.M.Thowker Hassan	151-23-4164
Md. Khairul Islam	151-23-4140

Supervised By:
Ms. Shamima Akter Smriti
Senior Lecturer,
Department of Textile Engineering
Daffodil international university

(A project is submitted in partial fulfilment of the requirements for the degree of **Bachelor of Science in Textile Engineering)**

Advanced in Fabric Manufacturing
November, 2018

Declaration

We hereby declare that, **Thesis Work** has been done by us under the supervision of Ms. S**hamima Akter Smriti** Senior lecturer of the Department of Textile Engineering, **Daffodil International University** and**, Professor Dr. Md. Mahbubul Haque,** Head of the Department, Department Of Textile Engineering, **Daffodil International University**, Dhaka.

We also declare that neither this **Thesis work** nor any part of this report has been submitted elsewhere for award of any degree

It is only submitted in partial fulfillment of the requirement of Bachelor of Science in Textile Engineering degree of Daffodil International University and we also remain responsible for the inadequacies & errors.

Paper Prepared By

Name of the Student's	**Student's ID No**	**Signature**
1. G.M.Thowker Hassan	151-23-4164	……..
2. Md. Khairul Islam	151-23-4140	…….....

Signature of supervising Teacher

……..

Ms. Shamima Akter Smriti

Senior Lecturer, Department of Textile Engineering
Daffodil international university

Acknowledgement

At first our gratefulness goes to Almighty Allah to give us ability to complete the thesis work. This thesis report marks the completion of the three weeks industrial training program undertaken as a part of B.S.C in Fabric Manufacture & Technology.

We are extremely thankful to our honorable supervising teacher**, Ms. Shamima Akter Smriti,** Senior Lecturer, Department of Textile Engineering, Daffodil International University.

We are extremely indebted for her fruitful guidance, criticism, constant inspiration and providing all necessary support for completing this thesis.

Again heartfelt thanks to **Prof. Dr. Md. Mahbubul Haque**, Head of Textile Engineering Department, Daffodil International University, for giving us the opportunity to carry out this report.

We would like to thank all **Respected Teachers** of the Department of Textile Engineering, DIU for their insightful information, advice and suggestions.

We are highly thankful to ***Fakir Kamruzzaman (Nahid)***, Managing Director Fakir Fashion Ltd, for permitting us to undertake this training at such a modern processing house and overall for the facilities that were made available for us in all the possible ways during this period.

We would like to thank the management of **FAKIR FASHION LTD.**

We would like to take this opportunity to thank all those people who helped us in this thesis and special thanks to **Mr. Abdullah- al- Azad**, Deputy Manager, knitting planning, Fakir fashion ltd, Who helped us to get an industry for internship.

Our deepest appreciation goes to **Md.Zanibul Haque**, Deputy Manager, knitting and **Md. Nazmul Hossain**, Senior officer also thanks **to Mr. Imran Saleh**, assistant officer, Knitting, Fakir Fashion ltd. for their outstanding support and guidance to complete this thesis work.

Finally, we would like to acknowledge with due respect the constant support and patients of our parents.

Letter of Approval

29th November, 2018

Shamima Akter Smriti
Academic Supervisor
Department of Textile Engineering
Daffodil International University

Subject: Submission of the thesis work on '**Study on material realization and waste generation in single jersey circular knitting machine'**.

Dear Madam,

With due respect, as student of Daffodil International University, we have prepared our thesis work on 'A survey on process loss of yarn during production in knitting on the basis of different criteria of raw material and machine'

We have tried our level best to follow your guidelines in every aspect of planning of this thesis work. We have also collected what we believe to be the most important information to make this thesis specific and coherent as possible. We enjoyed the challenge of preparing the thesis as it provided us with an opportunity to enlarge knowledge. We are honestly thankful for your guidance during the preparation of this thesis report. We hope you will appreciate our effort. We have done the study in a complete form and we have tried our level best to conduct this in a professional manner. It is true that, it could have been done in a better way if there were not limitations. We hope you will assess our report considering the limitations of the study.

Yours sincerely,

G.M.Thowker Hassan	151-23-4164
Md. Khairul Islam	151-23-4140

Signature of supervising Teacher

……..

Ms. Shamima Akter Smriti

Senior Lecturer, Department of Textile Engineering
Daffodil international university

Abstract

The textile factory in Bangladesh, specially the knit industries, where a huge amount of knit fabric is produce in daily basis. There also numerous types of raw material like yarns, various types of count of yarn are used according to the requirement of production. So in this aspect, though the production procedure is same for different knit products, major differents are seen during the time of production. It has been seen in often that the amount of production of fabric are few less with respect to the amount of inputting yarn. It has been recalled as the termed as Process loss (Process loss of yarn). Now question is what the reason behind this process loss is and how much amount in wt. of yarn wasted during production. To find out the answer of these question we have seen that the process loss impacted by some factors during production, Such as, Types of yarn, Yarn composition, Count of Yarn, Brand of Yarn, Yarn package, m/c r.p.m. skill of operator, yarn tension , loading of yarn , relative humidity etc. All necessary data's have been collected for day long above 8 hour per day (1 shift), and they were collected and rearrange as a form of Microsoft office word. And this thesis showed the find out the process loss for each of the criteria at a time for each of the single machine. Through this thesis work it is clear that the wastage of yarn is more in case of foreign brand compare with local brand during knitting.

Table of Contents

Table for figure

Table position

Table for graph:

Chapter-01
Introduction

1. Introduction

The readymade garments industry acts as the backbone of our economy and as a catalyst for the development of our country. We take pride in the sector that has been fetching billions of dollars as export earnings and creating jobs for millions of people in the country.

The "Made in Bangladesh" tag has also brought glory for Bangladesh, making it a prestigious brand across the globe. Bangladesh, which was once termed by cynics a "bottomless basket", has now become a "basket full of wonders." The country with its limited resources has been maintaining 6% annual average GDP growth rate and has brought about remarkable social and human development.

It is really a matter of great interest to many – how the economy of Bangladesh continues to grow at a steady pace, sometimes even when rowing against the tide. Now we envision Bangladesh achieving the middle-income country status by 2021. We firmly believe that our dream will come true within the stipulated time and the RMG industry will certainly play a crucial role in materializing the dream.

Knitting is one of the important industrial sectors of Bangladesh. The lion share our export oriented RMG is originated from knit fabrics Export means care about quality with the quantity.

Now with the vast amount of order of knit fabric from the foreign and domestic buyer order we now days have to produce huge amount of knit fabric. According to BKMEA we have exported 15490 million USD in 2015-2016 fiscal years.

But this huge production did not come from one industry or one type of machine or same design of fabric. There are a lot of industries in our country and a vast number of designed fabrics are produced. Different knitting machine has different production capacity, or same time the production efficiency is varying from machine to machine, design to design variation. And we also know that production of knitted fabric is varied for high count yarn, GSM, Stitch length, machine dia and gauge also.

Different industry in Bangladesh use different machine of different brand. Form which some off machine are highly productive some of branded machine are slow in production.

The following explanations are expected to be helpful in trying to specify the production efficiency for various machines with various knit criteria.

1.1 Objectives of this thesis:

1. Calculate the process loss of yarn
2. Finding out the reason behind process loss.
3. Determine the change of process loss due to various types of production parameters. Such as
    - Yarn type
    - Machine RPM
    - Yarn count
    - Fabric Type
4. To know about the recent work on that segments and find out the limitation
5. Find out the solution of reducing process loss.

1.2 Outline of this thesis

Chapter number	Chapter name	Description
1	Introduction	Introduction includes general discussion upon research work
2	Literature Review	Review of recent research work conducted related to this work, finding gap of those research and objective of this research work have been discussed.
3	Theoretical Background	This chapter includes a brief description of knitting, knitting machine, various knitting machine parts function, about process loss. Some Special types of yarn
4	Materials and methods	It describes the characteristic of material, process procedure, and some other machine parameter. Production quantity and efficiency on the basis of different machine on the basis of some important knitting machine criteria.
5	Result and discussion	The result and discussion describe the Process loss variation of yarn in knitting production on the basis of some criteria with graphical representation different.
6	Conclusion	Conclusions are reached. Recommendations are made for future study
7	References	In this chapter the journal, books, websites helped in this research work are referred
8	Appendix	

Chapter-2
Literature review

Literature review

The word knitting was come from a word ‘Knot’ which is derived from Dutch word. (Wikipedia) Knitting is a technique of producing fabric from yarn or wool. The very first artifact were sock from Egypt, about 11th century. (Wikipedia)

For soft and comfortable feel, good air porosity, well drapes, easy cost and good technical support, knit fabric demand is increasing day by day. In Paris 1912 after the silk fabric the demand of knit fabric is increasing. Now days they used more than 15 billion worthy of knit product per year. Though, v-bed flat knitting machine is use more than the circular knitting machine. (Matković V. M., 2011)

Now a day, the knit fabric production is more competitive than previous day. For making the product cost-effectible with increasing the production of fabric, the increase of efficiency is the major term of consideration. Here is many reason in textile industry for reduce the efficiency.

In knitting industry basically there are three factor of machine stoppage

1. Yarn characteristics (Breaking strength, elongation, count, filament or natural yarn)
2. Machine quality requirement (Machine maintenance and clearance)&
3. knitting production condition(Yarn count, machine setting, yarn storage, Air conditioning)

Basically machine stoppage, worker idleness, loose yarn and machine faults are the main reason of machine stoppage and this reason are reducing the efficiency. (M.H Reza, 2015)

The speed of the machine plays an
Important role in fabric defects. Thus, an optimum speed should be maintained for optimum Production. Speed of machine was increased by 1 & 2 rpm daily & negative impact of the various parameters like fabric defects, yarn breakages & needle defects was found. (Pawar Hemraj)

Some of the fabric where sophisticated method and design are used their production efficiency is remarkably low. Such as fleece, terry, 2*2 rib, double Lacoste etc. here a use of low count yarn is mandatory. So thus why, the rpm of machine is needed to be slow down to reduce the yarn breakage. So ultimately the efficiency of production is decrease. Though now days there are such company whom produce high rpm machine with less yarn breakage module and provide good quality of fabric. (Peled, november,2002)

There are some machine whom efficiency are high than the other, such as the machine which have more than one ring are provide more efficiency. Other hand, mechanical jacquard, Rachel and some multi guide bar and double needle bar machines do considerably reduce the complexity of guide movement thus their efficiency is higher by born. (Spencer, 1998)

Worker are also great responsible for lower efficiency. Due to their lower skillness, idleness, overtime, moral attitude, fatigue, absenteeism and turnover, security, holidays, new assignment or providing work out from their specific segments are the main reason of reducing the efficiency. (paper, 2012)

Value loss means missing of any property of material which is related to comfort, value addition, dimensional property, weight loss more than optimum value, low moisture content in fabric, bursting strength of material, shade variation during processing. Uses of unnecessary chemicals or wastage of chemicals or use the more amount of chemical than that is required is also taken into consideration of value loss.

Knitted fabric during processing undergo treatment like scouring, bleaching, dyeing, heat setting, softener application, relax drying, sanforising. These processes are carried out to impart particular property related to that process like scouring for absorbency, bleaching for whiteness, etc. At the dye house in busy schedule of production all these treatments are done, but the property related to that treatment is completely obtained or partially obtained is not checked for every lot and fabric undergo further treatment (Sandip G Patil*)

A research on productivity hour of worker show that, the lower the shifting hour or duty time provide more production and the more production means more efficiency. So it is proved that the 8hr shifting hour of a company produce more efficiently then a 12hr shifts company. (Pencavel, April 2014)

On the basis of that we can increase our production and machine efficiency of our knitting by ensuring 8hr shifting time. Though in Bangladesh, most of the knitting industries are 12hr basis shifting hour.

Process loss of yarn is also most important in knitting as efficiency. Which has a great impact on Production. Basically it is quiet impossible to get same amount of output [Fabric] by using raw material [yarn] due to several unavoidable cause like ,fly fiber , yarn breakage , lose yarn, cut yarn , Relative humidity , unconsciousness of worker etc. The production officer has to take the responsibility of production loss all time .They need to make a requisition of yarn for their production to yarn store. So being a production officer he should study about process loss to make an excellent requisition which is so effective to production according to their requirements.

To overcome the efficiency loss due to worker problem a research was also held in Australia. There they fund that, higher wages motivate employees to work harder. I mean higher wages attract more capable and productive workers. It leads to lower turnover, reducing the costs of hiring and training new workers. It enhances the quality and customer service. Reduce disciplinary problems and absenteeism also. (Wolfers, 2015)

In knitting industries and efficiency basis work is done on the efficiency loss reason, worker engage with loss of efficiency, how to increase the efficiency? There was mechanical reason for loss of knitting efficiency. Efficiency loss according to the basis of various knit fabric structure, Efficiency on v-bed flat knitting machine, and some knitting basis efficiency calculation.

When a defect occurs, the knitting machine has to be stopped and the fault corrected,
Thus resulting in time loss which is uneconomic. An effective monitoring of the knitting process is required in
Order to avoid or detect and locate a defect and its cause as soon as possible, avoiding

Productivity and quality losses.
In circular knitting machines the yarn input tension (Ti) can be used as a means of process. Control, so that defects may be prevented or quickly detected. This was found to be a valuable Approach to accomplish this task, since it reflects the general behavior of the knitting machine (Mário de ARAÚJO1)

2.1Study Gap:

Though there have been huge work, thesis and project are done on knitting section and its efficiency and yarn consumption also, but there was no specific work to finding the way to describe process loss% of yarn . No work is done with either yarn to yarn basis process loss% or neither knitting yarn brand to yarn brand process loss%, only idea is generated but data is insufficient.

Chapter-03
Theoretical Background

3. Theoretical background

3.1 About knitting

Knitting is a method by which yarn is manipulated to create a textile or fabric for use in many types of garments.

Knitting creates multiple loops of yarn, called stitches, in a line or tube form. Knitting has multiple active stitches on the needle at a time. Knitted fabric consists of a number of contentious rows of intermeshing of loops.

Knitting may be done by hand or by using a machine. Different types of yarns (fiber type, texture, and twist), needle sizes, and stitch types may be used to achieve knitted fabrics with different properties (color, texture, weight, heat retention, look, water resistance, and/or integrity). (Wikipedia)

3.2 Why knits are popular?

- Because of popularity of knitted fabric is mention below:
- It is usually soft compare with woven.
- Possible to easy movement.
- It has good stretch ability.
- It resists wrinkles.
- Good absorbency.
- Good air porosity and relatively low cost of simple fabrics.
- They have good burst strength.

3.3 There are two types of knitting:

1. Warp knitting
2. Weft knitting

In warp knitting, the Wales and courses run thoroughly parallel

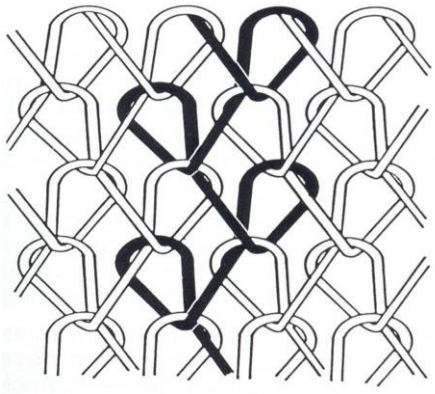


Fig 3.1: Warp Knitting

In weft knitting, the whole fabric can be produced from a single yarn, by adding stitches to each wale in turn.

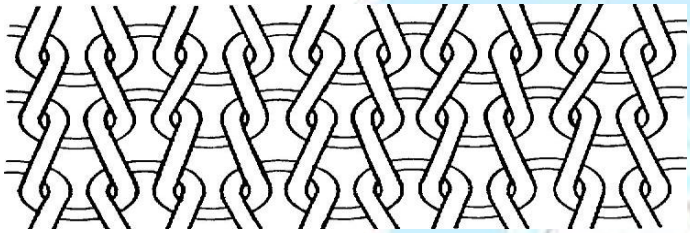


Fig 3.2: Weft Knitting

3.4 Type of knit Fabric:

1. single jersey
2. Single lacoste
3. Double lacoste
4. Polo pique
5. Plain interlock
6. 1×1 Rib
7. 2×1 Rib
8. 2×2 Rib
9. Single pique
10. Two Thread Fleece
11. Three Thread fleece
12. Ottoman
13. Waffle

3.5 Knitting machines:

Knitting machines are mainly two types. They are:

1. Weft Knitting Machine.
2. Warp Knitting Machine.

Warp knitting machine can be also divided into two types. They are:

I. Rachel.

ii. Tricot.

3.6 Basic Weft knitted structures:

1. Plain / Single knit structure.
2. Rib structure.
3. Interlock structure.

3.7 Single Jersey Circular Knitting Machine:

Circular knitting machine is widely used throughout the knitting industry to the produce fabric. This machine can be built in almost any reasonable diameter and the small diameter of up to five, which are used for wear. Machine for outerwear and under wear may vary from 12 inch to 60 inch in diameter according to manufactures requirement.

Fig 3.3: circular knitting machine

3.8 M/C parts name and function-

Serial No	Parts Name	Function
1	Creel	It is use to hold the yarn package.
2	Yarn Guide	The main function of this is to guide the yarn in proper direction.
3	Knot Catcher	To hold the dust and other extra impurities also knot. Only allow yarn pass. Through this.
4	Magnetic Tensioner	It is use to pass the yarn with proper direction also hold the yarn loosely.
5	Positive Wheel	To feed the specific amount of yarn keeping proper tension and ensure even yarn feed.
6	Sensor	To stop the yarn after breaking a single yarn as result machine will stop.
7	Indicator light	The function of this device is to identify the feeder or wheel place where yarn break.
8	Ceramic Eye Guide	To guide the yarn properly to the feeder.
9	Yarn Feeder	To feed the yarn to the needle for loop formation.
10	Sinker	The main function is to hold the old loop and help to formation of new loop.
11	Needle	To stretch the thread and making new loop also pass the new lop through the old loop.
12	Sinker Ring	To support sinker cam also sinker.
13	Sinker	To make sinker path also give to and fro motion

	cam/Timing	properly.
14	Feeder Ring	To hold the feeder.
15	Sinker Bed	This is use to hold/place the sinker.
16	Cylinder	To hold and place the needle in right position.
17	Base Plate	To hold and place the cylinder properly.
18	Sinker Ring Supporter	To hold the sinker ring, feeder ring tightly.
19	Needle Cam	To make a path for needle for accelerating through in the cylinder according the fabric construction.

Table 4.2: Machine parts and function

3.9 Some description on important Parts of Circular Knitting Machine:

1. **Creel:** Creel is a part of a knitting machine. Hear yarn package are store and ready to feed in the machine.

2. **VDQ Pulley:** It is a very important part of the machine. It controls the quality of the product. Altering the position of the tension pulley changes the G.S.M. of the fabric. If pulley moves towards the positive directive then the G.S.M. is decrease. And in the reverse direction G.S.M will increase.

3. **Pulley Belt:** It controls the rotation of the MPF wheel.

4. **Brush:** Its clean the pulley belt. Tension Disk: It confronts the tension of the supply yarn. Inlet and Outlet Stop Motion: It is an important part of the machine. It stops the machine instantly when a yarn is break.

5. **Yarn Guide:** Its help the yarn to feed in the feeder.

6. **Positive feeder:** Its use to feed specific amount of yarn and ensure even feed.

7. **Thread guide pipe:** It is to guide the yarn through proper direction..

8. **Magnetic tensioner:** Use to pass the yarn proper direction also loosely hold the yarn.

9. **Sensor;** Use to stop the machine when yarn break.

10. **Feeder:** Feeder is help yarn to feed in to the machine.

11. **Needle Track:** Where all Needles is placed together in a decent design.

12. **Needle:** It is a principal element of the knitting machine. It helps the yarn to create a loop. And by this way fabric are produce. Prior to yarn feeding the needle is raised to clear the old loop from the hook, and received the new loop above it on needle stem. The new loop is then enclosed in the needle hook as the needle starts to descend.

3.10 According to the butt position latch needles are 4 types:

1. One butt latch needle
2. Two butt latch needle
3. Three butt latch needle
4. Four butt latch needle

3.11 Different Parts of Latch Needle:

There are six main parts of latch needle with short info, they are:

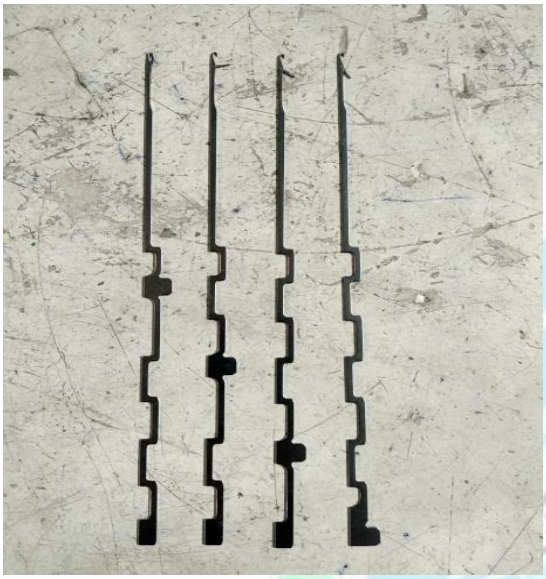


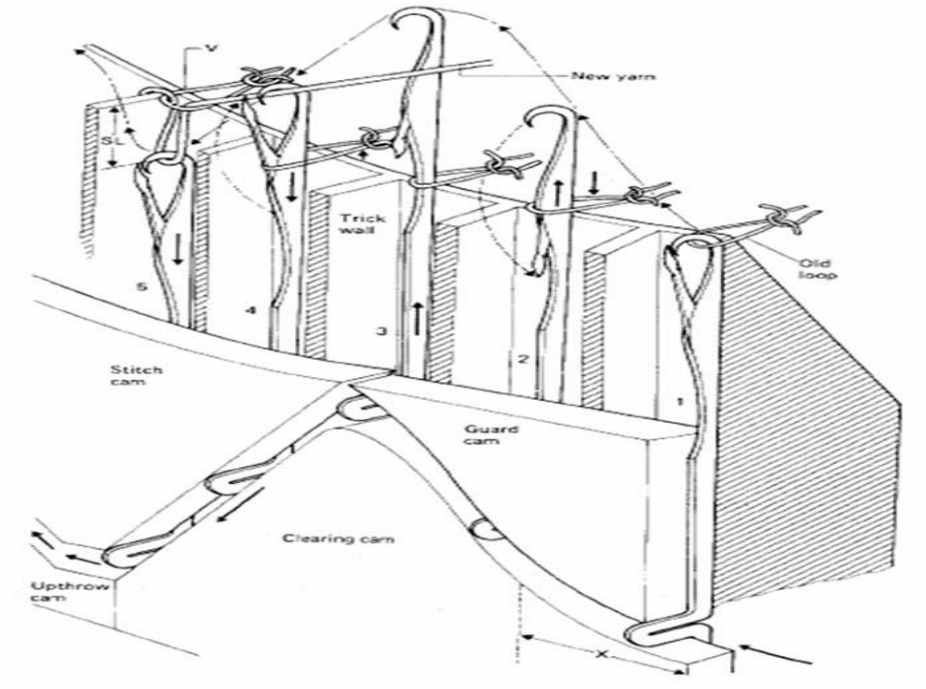
Fig 3.4: Latch needle

1. **Hook:** The hook is used to catch a thread and form loops
2. **Latch blade:** This latch blade locates the latch in the needle.
3. **Latch spoon:** The latch spoon is an extension of blade and bridges the gap between the hook and stem.
4. **Stem:** The stem of latch needle carries the loop in the clearing on rest position.
5. **Butt:** Butt of latch needle enables the needle to be reciprocated.
6. **Tail:** The tail is an extension below the butt giving additional supp9ort to the needle and keeping the needle in its trick

3.12 Knitting Action of the Latch Needle:

The position of a latch needle as it passes through the cam system, completing one knitting cycle or course as it moves up and in its trick or slot.

1. **The rest position:** The head of the needle hook is level with the top of the verge of the trick. The loop formed at the previous feeder is in the closed hook. It is prevented from rising as the needle rises, by holding-down sinkers or web holders that move forward between the needles to hold down the sinker loops.
2. **Latch opening:** As the needle butt passes up the incline of the clearing cam, the old loop, which is held down by the sinker, slides inside the hook and contacts the latch, turning and opening it.
3. **Clearing height:** When the needle reaches the top of the cam, the old loop is cleared from the hook and latch spoon on to the stem. At this point the feeder guide plate acts as a guard to prevent the latch from closing the empty hook.
4. **Yarn feeding and latch closing:** The needle starts to descend the stitch cam so that its latch is below the verge, with the old loop moving under it. At this point the new yarn is fed through a hole in the feeder guide to the descending needle hook, as there is no danger of the yarn being fed below the latch. The old loop contacts the underside of the latch, causing it to close on to the hook.
5. **Knocking-over and loop length formation:** As the head of the needle descends below the top of the trick, the old loop slides off the needle and the new loop is drawn through it. The continued descent of the needle draws the loop length, which is approximately twice the distance the head of the needle descends, below the surface of the sinker or trick-plate supporting the sinker loop. The distance is determined by the depth setting of the stitch cam, which can be adjusted.



.

3.13 Advantages of Latch Needle:

The latch needle has the major advantage of being self-acting or loop-controlled, so that individual movement and control of the needle enables stitch selection to be achieved. It is ideally suited for use with computer-controlled electronic selection devices.

13. **Sinker:** It is most important element of the machine. Its help to loop forming, knocking over and holding down the loop.

3.14 Knitting sinker

The sinker is the second primary knitting element (the needle being the first).

3.15Functions of a sinker

It may perform one or more of the following functions; dependent upon the machine's knitting action and consequent sinker shape and movement:

1. Loop formation
2. Holding-down
3. Knocking-over

Fig 3.6: Knitting sinker

3.16 Various parts of sinker:

1. Butt
2. Stamp/Shank
3. Hook
4. Nose
5. Throat

14. **Sinker Ring:** Sinker ring is a ring. Whereas all sinkers are placed together.

15. **Cam Box:** Where the cam are set horizontally.

16. Cam:

Cam is device s which converts the rotary machine drive in to a suitable reciprocating action for the needles and other elements.

Types of cam:

knitting cam are 3 types

1. Knit cam
2. Tuck cam
3. Miss cam

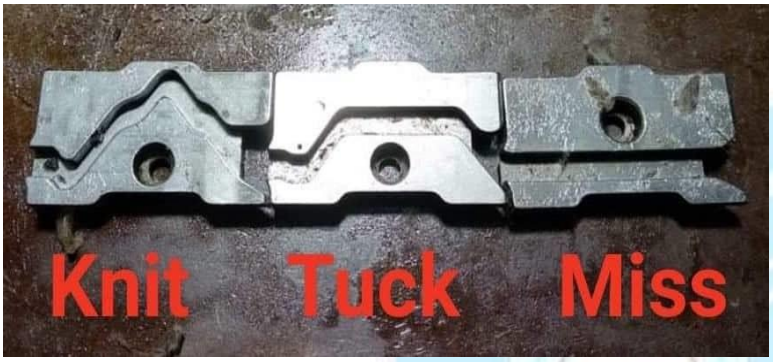


Fig 3.8 : Knitting cam

Function of cam:

The function of cam is given below

1. Produce motion of needles
2. Drive the needle
3. Formation of loop

17. **Lycra Attachment Device:** Lycra is placed hear. And feed to the machine.

18. **Lycra Stop Motion:** It is one kind of stop motion to stop the machine when the Lycra is break.
19. **Cylinder:** Needle track are situated hear.

20. **Cylinder Balancer:** It helps the cylinder to set in a proper alignment.

21. **Adjustable Fan:** This part removes lint, hairy fibre from yarn and others. It cleans the dust by air flow.

22. **Spreader:** Used to make tension in width wise direction of fabric during take up action.

23. **Base plate:** This is used to hold or place the cylinder.

24. **Air Gun Nozzle:** To feed the yarn; sometimes it is used for cleaning purpose.

3.17 Procedure of GSM measurement by GSM cutter:

1) Cut the fabric with the G.S.M cutter.
2) Weight the fabric with the electric balance.
3) The cut sample is 100sq.cm. The weight of the cut sample is multiplied by 100.
4) The result is the G.S.M of that particular fabric.

As for example

The weight of the fabric is 2.51 gm. That means the G.S.M of the fabric is 251 gm.

3.18 Stitch Length of Fabric Sample

Stitch Length should be checked whenever starting the new order or problem arises. The use of round meter for setting the stitch length is better. However, if it is not available then, it may be checked manually. But in any case, it must be checked when starting the new article or in case of any problem.

3.19 Production Calculation:

Nominal Production of knitting machines

- One of the very simple ways to calculate knitting machine production by weighing the total production of one hour or one shift or one day.

In this method following information for production calculation are required:

• Machine Guage and Dia

• RPM Knitting Machine

• Yarn Count

• Stitch Length , count and feeder.

From these data we can calculate the length of yarn being used by the machine in one hour and then by converting this length into weight with the help of count given we can calculate the quantity of yarn being consumed by machine in one hour. This would be the optimum production of the machine. This optimum production can be converted into nominal production by multiplying it with efficiency.

Number of needles = machine dia * gauge * π (3.14)

3.20 Production for S/J Cotton yarn

$$\frac{NON * NOF * Time * Efficiency * Stitch\ length * RPM * 0.00000059}{Count(\text{NE})}$$

3.21 Calculation for fleece yarn:

The production calculation is done for three different yarns. Surface, binder and loops are those yarns. So their calculation needs to be different and after calculation each of their production we need to sum this.

3.22 Production calculation for the fleece fabric:

$$\frac{NON * 0.00000059 * NOF * Time * Efficiency * Stitch\ length * RPM}{Count(NE)}$$

3.23 Causes of production interruption:

1. Yarn breakage
2. Loose feeding of yarn
3. Quality check during production
4. Doffing
5. Counter stoppage
6. Cleaning
7. Cone change
8. Electric supply off

9. Needle break
10. Load shedding
11. Maintenance
12. Natural calamities
13. Political unrest

3.24 Efficiency:

Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. In a more general sense, it is the ability to do things well, successfully, and without waste. In more mathematical or scientific terms, it is a measure of the extent to which input is well used for an intended task or output.

Theory of finding efficiency: (Efficiency, 2017)

$$\frac{\text{Actual produciton X100}}{\text{Calculate production}}$$

Process loss%

Generally the raw material like yarn has to cross several actions to make fabric by knitting process. As knitting production is calculated in weight, its quiet difficult to get same amount of fabric by using same amount of yarn .There is always found a difference between output and input which is expressed in percentage and known as process loss% .There could be found process gain also .

Process loss% or Process gain% could be varied from yarn to yarn, count to count, brand to brand etc. We tried to present some data and difference of process loss% between yarn to yarn, count to count, brand to brand. .

$$\textbf{Process loss\% of yarn in knitting} = \frac{\textbf{(Input}-\textbf{output)in kg}}{\textbf{Input in kg}} \times 100$$

Obviously there could be some important factors/reason behind the process loss% or Process gain%.

They are -

1) Lose yarn

2) Cut yarn.

3) Knot yarn.

4) Fly fiber

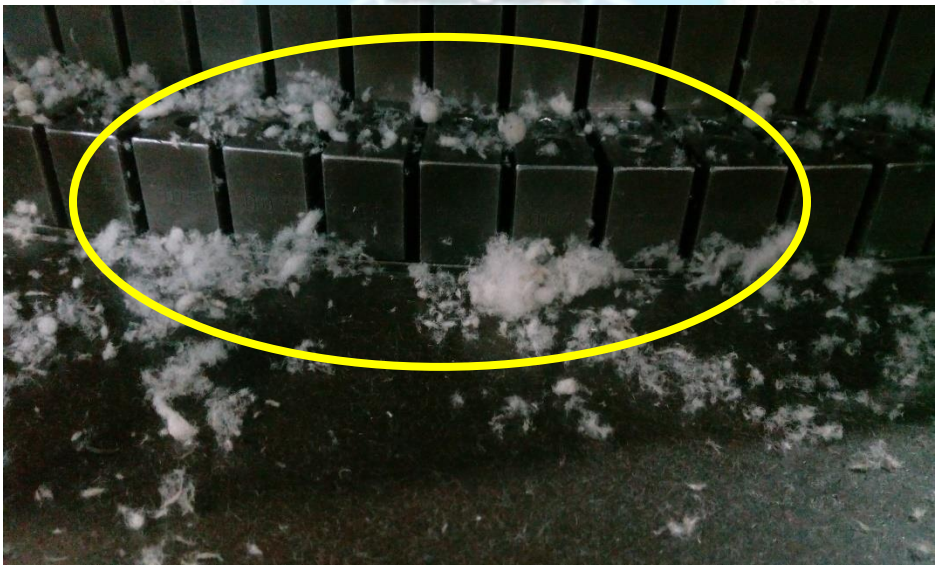
5) Moister/ humidity.

Here some picture of these reason to clear it-

Picture-3.9; Lose yarn

Picture-3.10; Cut yarn/Cut End

Picture-3.11; Knott yarn.



Picture-3.12;Fly fiber

Chapter-04
Material and method

Materials -

1. Yarn Package-

Here yarn package use on the basis of different count, Brand and types.

Types of Yarn	Yarn count	Brand
Grey Mélange	30/1	Multazim
Combed	34/1	Bhardhaman
Combed	24/1	Omat
Grey Mélange	40/1	Multazim
Combed	40/1	Metro
Pima cotton	32/1	Patspin

Table 4.1 : Types of yarn use and count, brand.

The yarn used-

Grey Mélange – Basically grey mélange consist of viscose and cotton.

It is three types

1. Grey Mélange.
2. Ecru Mélange.
3. Anthra Mélange.

Combed yarn- Combing creates a smoother yarn as the fibers are more aligned. It is expensive process than card process.

Pima cotton- Pima cotton is the cotton where use only 10 percentage of short fiber and other 90 percent is staple fiber.

Lifter-

As we needed numerous numbers of intakes cone or yarn package we had to use lifter to carry packages very carefully.

Electric Balance-

To record the weight of every single package, as well as every single fabric role its needed to use Electric balance to get the proper weight of every single packages and every single fabric role.

Calculator-

To calculate process loss properly.

M/C Specification-

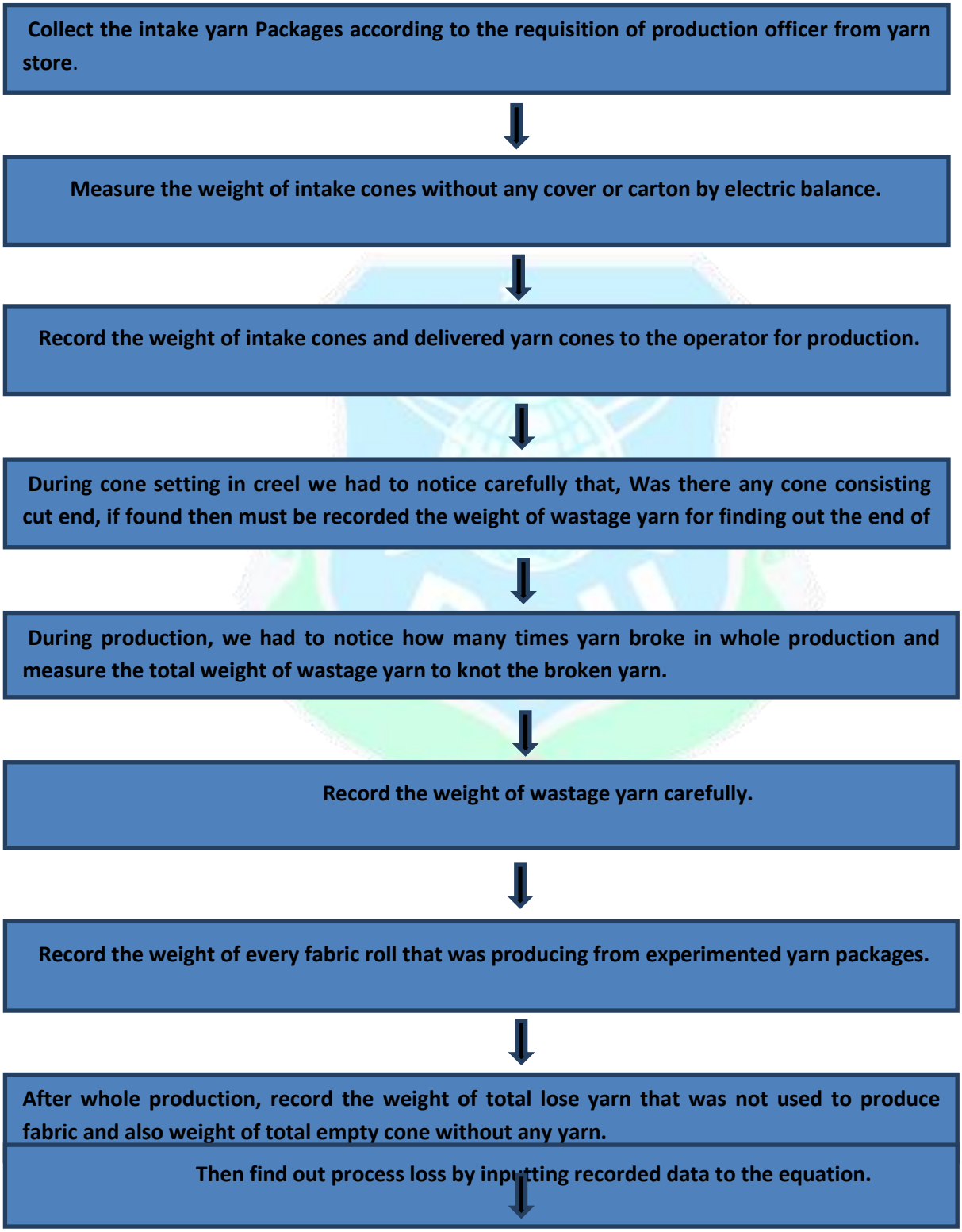
On the basis of different types, brand, dia, gauge, feeder and RPM which use to complete the thesis work.

M/C No	M/C Types	Brand	Dia	Gauze	Feeder	R.P.M
O3	S/J	PILOTELLI	38	24	112	22
07	S/J	JUNNLONG	40	24	120	23
17	S/J	PILOTELLI	40	24	120	23
19	S/J	PILOTELLI	38	24	114	18
22	S/J	JUNNLONG	36	24	144	20
38	S/J	PILOTELLI	34	28	102	22

Table 4.3 : Machine specification.

Method of Process loss

The process flow chart is given below;-



Data-5

Required data for find out process loss and calculation –

M/C No = 22, Dia = 36 Gauge = 24, Feeder = 142

Yarn description - Brand =Metro. Lot No = 149h140886

Count = 40/1, combed yarn.

Data Table-5

Sl No.	No. of cone	Weight Of grey yarn	No. Of Fabric Roll	Weight of grey fabric in Kg/roll
01	44	117.92 Kg	01	29.02 Kg
02	34	88 Kg	02	25.1 Kg
03	44	118.92 Kg	03	23.5 Kg
			04	25.70 Kg
			05	25.20 Kg
			06	25.80 Kg
			07	25.70 Kg
			08	25.66 Kg
			09	25.72 Kg
			10	25.59 Kg
			11	25.70 Kg
			12	25.82 Kg
			13	25.65 Kg
			14	25.72 Kg
Total	142	379.5 kg	14	359.88 Kg

Total weight of Loose yarn with cone paper = 16.62 Kg yarn which are not use.

Process loss % =

Actual weight of yarn is used = 379.5 – 16.62 Kg = 362.88 Kg

Wastage of yarn while using 362.88 Kg yarn =362.88 -359.88 Kg = 3 Kg

$$\text{Process loss \%} = \frac{3 \times 100}{362.88} = .83\ \%.$$

Chapter-05
Result and discussion

5. Result and Discussion

Data Table-5.1

Overall information / data that was collected, given below;-

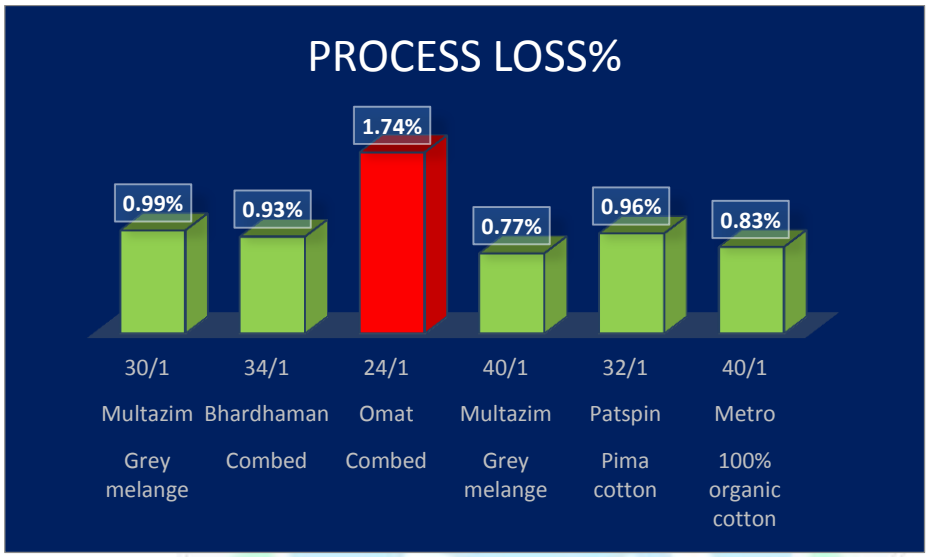
Yarn type	Brand	Origin	Count	Wt. of grey yarn	Wt. of used yarn	Total wt. of fabric	Residual yarn	Wastage	Process loss%
Grey Mélange	Multazim	BD	30/1	240.5 Kg	**202.8 Kg**	**200.8 Kg**	37.7 Kg	2 Kg	**0.99%**
Combed	Bhardhaman	AB	34/1	327.5 Kg	**313 Kg**	**310.1 Kg**	14.5 Kg	2.9 Kg	**0.93%**
Combed	Omat	BD	24/1	234.9 Kg	**223.9 Kg**	**220 Kg**	11 Kg	3.9 Kg	**1.74%**
Grey Mélange	Multazim	BD	40/1	236.6 Kg	**206.6 Kg**	**205 Kg**	30 Kg	1.6 Kg	**0.77%**
Pima Cotton	Patspin	AB	32/1	267.3 Kg	**259.7 Kg**	**257.2 Kg**	8 Kg	2.5 Kg	**0.96%**
100% organic cotton	Metro	BD	40/1	379.5 Kg	**362.88 Kg**	**359.88 Kg**	16.62 Kg	3 Kg	**0.83%**

Data-5.2

Yarn type	Brand	Count	Total number of cone	Total weight of cone	Total wt. of cone paper.	Total wt. of Lose yarn	Lose yarn% based on cone paper	Residual yarn for re-coning
Grey Mélange	Multazim	30/1	**110**	**240.5kg**	**5.11 kg**	**423.5g**	**.375%**	**32.15 kg**
Combed	Bhardhaman	34/1	**121**	**327.5kg**	**5.62 kg**	**123.4 g**	**.10%**	**8.76 kg**
Combed	Omat	24/1	**120**	**234.9kg**	**5.18 kg**	**118.8 g**	**.099%**	**5.70 kg**
Grey Mélange	Multazim	40/1	**112**	**230.5kg**	**5.39 kg**	**425.6 g**	**.38%**	**24.19 kg**
Pima Cotton	Patspin	32/1	**101**	**267.3kg**	**4.62 kg**	**107.06 g**	**.10%**	**3.27 kg**
100% organic cotton	Metro	40/1	**142**	**379.5kg**	**6.64 kg**	**539.6 g**	**.37%**	**9.44 kg**

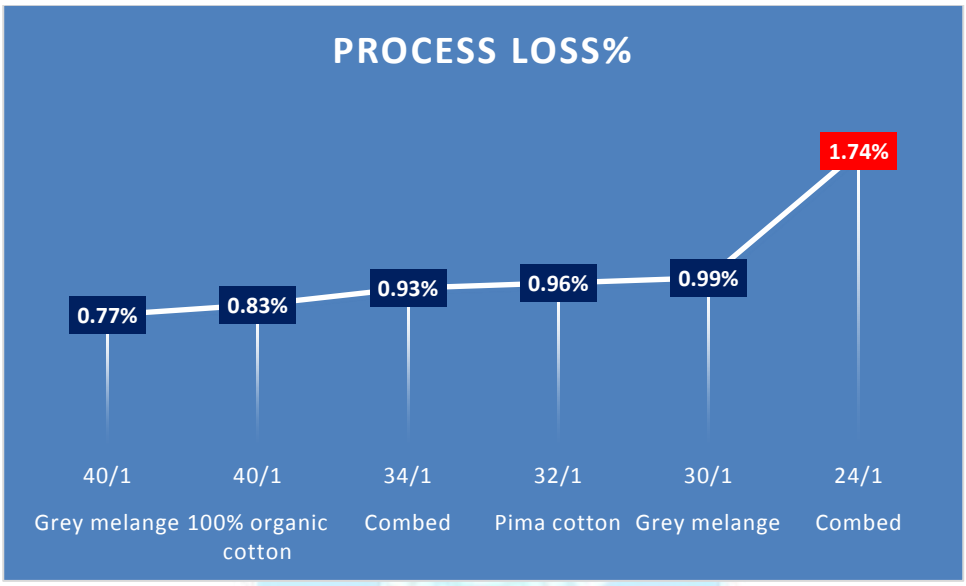
Table-5.2: Amount of lose yarn%, cone weight.

1. **Here show the wastage of yarn on the basis of different type of yarn used during knitting.**



Graph-1- Process loss % of different types of yarn

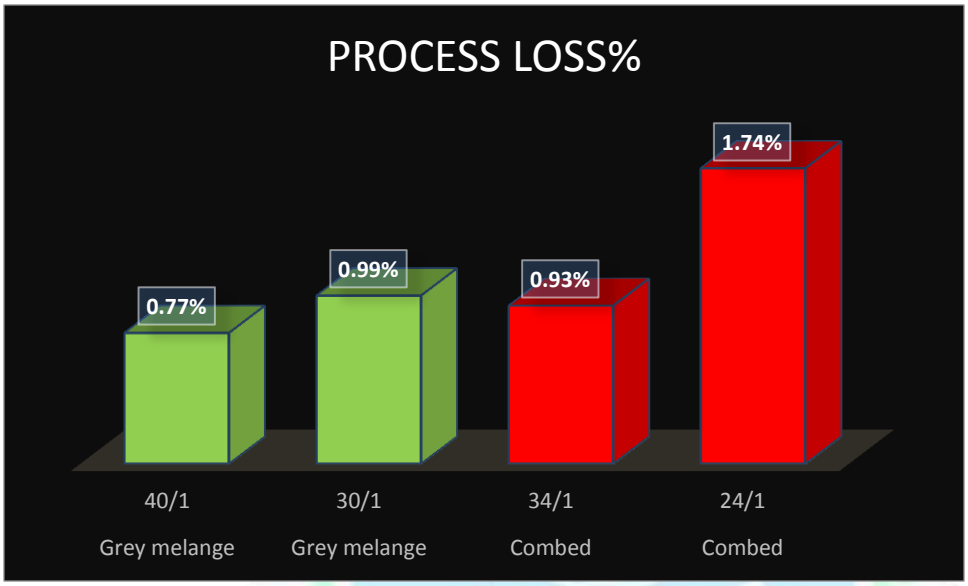
2. Here show the effect yarn wastage due to use different count.



Graph -2; Process loss % among different types of yarn count

From the above figure, it is shown few difference of Process loss% among different types of yarn during knitting. The difference of process loss% among yarn depends on several factors. Yarn count is one of these factors which is so important. The graph shown that the process loss% are increasing with the decrease of yarn count.it is happened, because the TPI is decreasing with the decrease of yarn count in yarn. Higher count yarn has more TPI than Lower count yarn. As lower count yarn has less TPI, there is a more chance to get out fiber from the yarn easily. To get more clearance about this factors, an additional graph which is broken down form above graph is given below -

3. Here show the yarn loss percentage for same yarn but different count
   Like, For Grey mélange 40/s wastage 0.77 %
   Grey mélange 30/s wastage 0.99 %



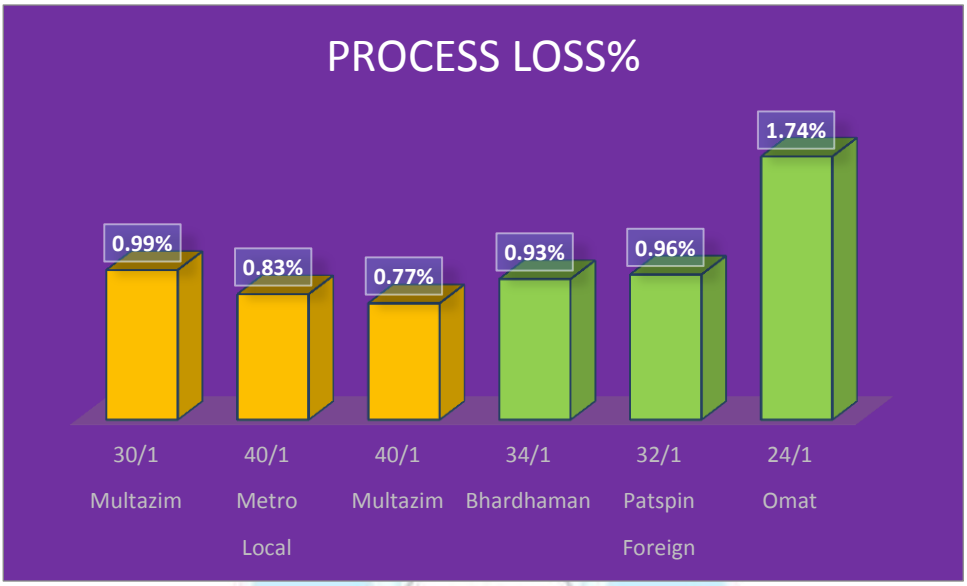
Graph – 3; Process loss % between same yarn of different count

The graph is showing a difference of process loss% between same yarn but different count.

It is showing clearly that the process loss% of 40/1 Ne, grey mélange is less than 30/1 Ne, grey mélange yarn

Also showing the process loss% of 34/1 Ne Combed yarn is less than 24/1 Combed yarn which is proved that the process loss% is increasing with the decrease of yarn count.

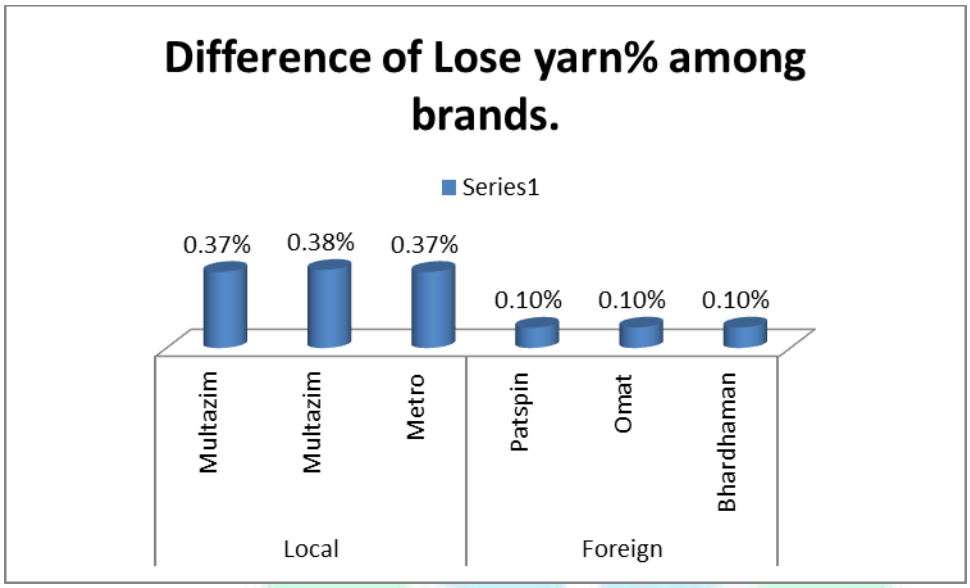
4.This graph shows the yarn wastage on the basis of foreign and local brand.



Graph-4: Process loss% among different brands.

From the Above graph it has been founded that the process loss% of yarn during knitting is more in Local brand yarn than the foreign brand .there is also a reason behind this. The reason is loose yarn content. The amount of loose yarn in local brand is more than Foreign brand yarn. It is found after weighting loose yarn that the local yarn has 3.5gm to 4.86gm (approx.) loose yarn. And the foreign brand yarn has .5gm to 1.02gm loose yarn. That's why the process loss % of yarn of local brand should be more than the foreign brand. But process loss % changing in several factors whereas loose yarn is a single factor. The graph is showing few difference with theory because it is presented on process loss% based on loose yarn content , cut yarn , yarn count etc.

4. By this graph show the lose yarn percentage for different brand.



Graph 5 :Lose yarn for different brand.

Daffodil International University
D I U

Chapter-06
Conclusion

6. Conclusion:

Basically in this thesis, it discussed about the efficiency and the process loss of textile industries, it show the calculated efficiency of knitting machine also. Here also discussed about reason behind the process loss during knitting also how to minimize process loss.

But basically the thesis work is done for categories the efficiency difference for various knitting parameter from machine to machine with some of their basic production criteria, Such as machine RPM, yarn count, fabric type etc. In this thesis it is also tried on a supreme level to focus on how possible to decreasing process loss.

Due to some short of machine it was not possible to discuss about fleece, pearl, lacoste, and some of other design fabric. So, other can try on this segment. According to operator opinion production of fabric is more in night shift from day shift. So, one can try on the night shift production.

For more theoretical background knowledge one can read the book on “knitting technology” by David Spencer, this book has 3 editions yet. I read only one edition. There is huge information about knitting section which is stored as a PDF format in Daffodil International University as a project format one can also download for this purpose.

After all one thing is really need to mentioned that the efficiency and process loss depends not only to the machine type or other knitting parameter but also it depends on the good environment of production floor, honesty and respectful behave to each other also help to increase the knitting efficiency and decrease the process loss over all.

Chapter-07
References

References

Factors Affecting Construction Labor Productivity. (2012). White paper.

Efficiency. (2017). Wikipidea.

Akaydin, M. (march 2009). Chracteristics of fabric knitted with basic knitted structure from combined ring and combed yarn and commpact yarn. Indian journal of fiber anf textile researh, 22-30.

.M.H Reza, K. H. (2015). A Study on causes of knitting machine. European scientific journal.

Mário de ARAÚJO1, A. C. (n.d.). Process Control for Total Quality in Circular Knitting.

Matković, V. M. (2011). Technological reasons for entering knits in the fashion of the 20's. TEDI - International Interdisciplinary Journal of Young..

Pawar Hemraj, P. R. (n.d.). A study on improving the Knitting Machine Efficiency.

Peled, A. (november,2002). Fabric structure and its reinforcing efficiency in textile. Composites.

Pencavel, J. (April 2014). The Productivity of Working Hours. I Z A.

Sandip G Patil*, P. R. (n.d.). i Study on the value loss in processing of knit and measures to improve it.

Spencer, D. j. (1998). knitting technology . cambridge,England: woodhead publication.

.Wolfers, J. (2015, january 13,). Peterson institute for international economics.

Chapter-08
Appendices

8. Appendices

In this thesis work the data are mainly collected from the single jersey knitting machine. And the design such as terry, lacoste, and single jersey Lycra are produced in the same machine by changing the cam arrangement, needle arrangement and the sinker arrangement. So in some sort of case the data can similar to the single jersey knitting machine. There are special machine for the production of design knitting fabric. Though the single jersey knitting machine can produce those types of products, but the quality and the machine efficiency are not same for both types knitting machine.

The whole production calculation is done on the basis of same knitting calculation. So it was observed that the production calculation was more reliable and trust worthy.

Basically for some predictable thing the thesis is stands for, so above all of this discussion it can be easily said that the efficiency can easily be increased by careful management of production floor also possible to reduce the process loss percent.