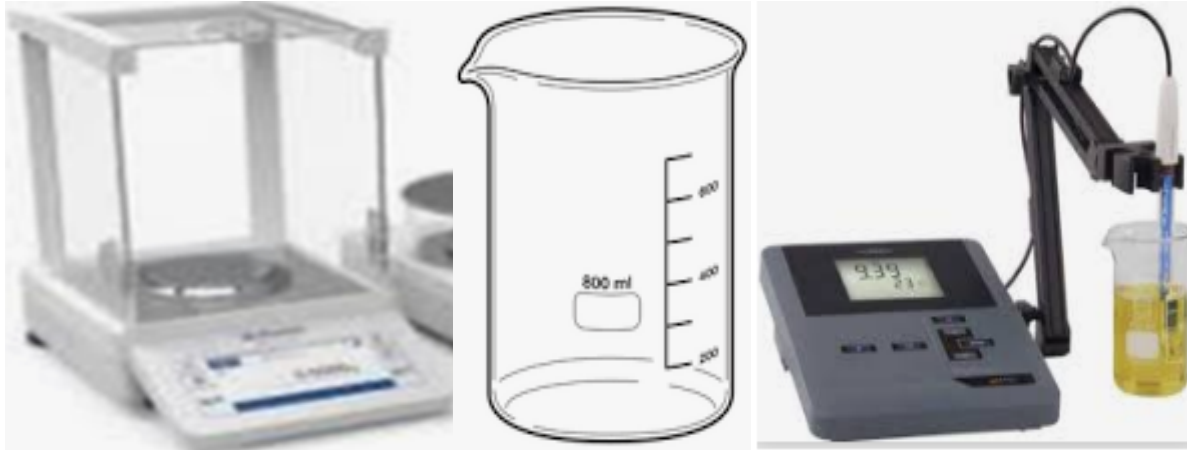


Textile Processing Technology

Level-II

Based on March 2022, Curriculum Version 1



Module Title: - Weigh and Check Textile chemical processing inputs

Module code: IND TPT2 M02 0222

Nominal duration: 70Hour

Prepared by: Ministry of Labour and Skill

August, 2022

Addis Ababa, Ethiopia

Table of Contents

Acknowledgment	6
Acronym	7
Introduction to the Module	8
Unit one: Job requirements	9
2.1 Standard operating procedures (SOPs).....	10
2.2 Complying with work health and safety (WHS)	10
1.2.1 Hazard identification and control	11
1.2.2 Risk assessment.....	11
1.2.3 Implementation of risk reduction measures	11
2.3 Personal protective equipment (PPE)	11
2.4 Identifying job requirements.....	12
Self-Check – 1	14
Unit Two: Weighing	16
2.1 Identifying and taking fibers, yarns, fabrics, dyestuffs, chemicals and auxiliaries samples.....	17
2.2 Organizing weighing or measuring equipment.....	24
2.3 Checking calibration.....	25
Self check-2	27
Operation sheet-2	30
LAP TEST-2	34
Unit Three: Textile chemical processing inputs weighing	35
3.1 Weighing Fibers, yarns, fabrics, dyestuffs, chemicals and auxiliaries	36
3.2 Recording and Documenting weights.....	38
Self check-3	39
Operation sheet-3	40
LAP TEST-3	43
Unit Four: Textile chemical processing inputs checking	44
4.1 Checking inputs quality	45
4.2 Checking raw materials weight	47
Self check-4	49
Operation sheet-4	50
LAP TEST-4	52
Unit Five: Documentation	53

5.1	Checking inputs documentation	54
Self check-5	55

List of Figures

Figure 2.1: Inspecting yarn’s appearance and texture	19
Figure 2.2: felting test.....	19
Figure- 2.3: Burning yarn	19
Figure 2.4: Dissolving yarn in chemicals	20
Figure 2.5: Fabric burning test.....	21

Figure 2.6: Weighing balances	24
Figure 2.7: Beakers	24
Figure 2.8: Pipette.....	24
Figure 2.9: Measuring cylinders	25
Figure 2.10: Flasks.....	25
Figure 2.11: PH meter.....	25
Figure 3.1: Dial - O - Gram Mechanical Balance.....	36
Figure 3.2: MT Microbalance.....	36
Figure 3.3: Electronic Torsion Balance	37
Figure 4.1: Calorimeter.....	46
Figure 4.2: Block diagram of spectrophotometer components.....	46

List of Tables

Table 2.1 Burning Characteristics of textile fibers	31
Table 4.1: Weights WPI chart	48

Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

Page 5 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
--------------	--	---	----------------------------

Acronym

1. **SOP**- standard operating procedures
2. **WHS** - Complying with work health and safety
3. **PPE** - personal protective equipment
4. **LAP** Test – Learning Activity and Performance
5. **SDL** – Simple Data Logger
6. **WPI** - Warp per Inch

Introduction to the Module

In textile processing technology field; weighing and checking Textile chemical processing inputs the helps to know job requirements; how to prepare weighing tools, how to prepare textile chemical processing inputs for weighing, how to check textile chemical processing inputs, and how to document textile chemical processing inputs.

This module is designed to meet the industry requirement under the Textile Processing Technology occupational standard, particularly for the unit of competency: **Weigh and Check Textile chemical processing inputs.**

This module covers the units:

- Job requirements
- weighing preparation
- Textile chemical processing inputs weighing
- Textile chemical processing inputs checking
- Documentation

Learning Objective of the Module

- Determine job requirements
- Prepare for weighing
- Weigh textile chemical processing inputs
- Check textile chemical processing inputs
- Confirm documentation

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: Job requirements

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Standard operating procedures (SOPs)
- Complying with work health and safety (WHS)
- Using personal protective equipment (PPE)
- Identifying job requirements

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Follow standard operating procedures (SOPs).
- Comply with work health and safety (WHS) requirements at all times.
- Use appropriate personal protective equipment (PPE) in accordance with SOPs.
- Identify job requirements from specifications, drawings, job sheets or work instructions.

1.1 Standard operating procedures (SOPs)

Page 8 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
--------------	--	---	----------------------------

Standard operating procedures are written, step by step instructions that describe how to perform a routine activity. Employees should complete them in the exact same way every time so that the business can remain consistent. Standard operating procedures help maintain safety and efficiency for departments such as:

- Production /operations
- Sales and customer service
- Employee training
- Legal
- Financial

A standing operating procedure should never be difficult to read or vaguely worded.

It should be brief, easy to understand and contain actions steps that are simple follow A good standard operating procedures should clearly outline the steps and inform the employee of any safety concerns.

The standard operating procedures should be the bases for training any new employees. They should also be updated every year to ensure they stay relevant to the current needs of the organization.

1.2 Complying with work health and safety (WHS)

Compliance with work health and safety is the state of being in accordance with established guidelines of work health and safety or specifications, or the process of becoming so. The definition of compliance can also encompass efforts to ensure that organizations are abiding by both industry regulations and government legislation.

Compliance is a prevalent business concern, partly because of an ever-increasing number of regulations that require companies to be vigilant about maintaining a full understanding of their regulatory requirements for compliance.

To adhere to compliance standards, an organization must follow requirements or regulations imposed by either itself or government legislation.

2.1.1 Hazard identification and control

Concepts of hazards:

Hazard: Anything (e.g. condition, situation, practice, behavior) that has the potential to cause harm.

Page 9 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
--------------	--	---	----------------------------

Hazard Identification:

This is the process of examining each work area and work task for the purpose of identifying all the hazards which are “inherent in the job”.

Hazard control measure:

All workplace hazards (chemical, physical, etc.) can be controlled by a variety of methods. Some methods of hazard control are more efficient than others, but a combination of methods usually provides a safer workplace than relying on only one method. Some methods of control are cheaper than others but may not provide the most effective way to reduce exposures.

2.1.2 Risk assessment

Risk Assessment is defined as the process of assessing the risks associated with each of the hazards identified so the nature of the risk can be understood. This includes the nature of the harm that may result from the hazard, the severity of that harm and the likelihood of this occurring.

2.1.3 Implementation of risk reduction measures

Specifically to this competence Risk reduction measures implementation may include. Manual handling techniques, Standard operating procedures, Personal protective equipment , Safe materials handling, Taking rest breaks, Ergonomic workplaces arrangement , Following marked walkways, Safe equipment storage, Housekeeping, Reporting accidents and incidents and Environmental practices. These are explained as follow.

2.2 Personal protective equipment (PPE)

Personal protective equipment (PPE) is a tool that you use to guarantee your own safety. Personal Protective Equipment includes: fire retardant or chemical-proof clothing for over all body, gloves for hands, hard hats or helmets for head, breathing musk for respirators, safety spectacles for eyes, goggles or face shields for faces and boots for foot.

Eye and face protection equipment’s are used to protect against flying particles and foreign bodies, corrosive chemicals, fumes, lasers and radiation. The two basic problems in wearing eye and face protectors are:

- a) How to provide effective protection which is acceptable for wearing over long hours of work without undue discomfort and
- b) The unpopularity of eye and face protection due to restriction of vision. The wearer’s peripheral vision is limited by the side frames.

There are different types of eye and face protection equipment. So at any workplaces, safety clothes required for specific work must be given to workers and must be supervised by their respective work manager whether they wear or not.

2.3 Identifying job requirements

A job is defined as anything a person is expected or obliged to do, duty and responsibility he /she has or the process or requirements, details, etc., of working or the execution/completing or performance of a task.

Job requirements may include the following:

- Job Specifications,
- Drawings,
- Job sheets or
- Work instructions

A job specification: is the list of recommended qualities for a person to qualify for and succeed in a position. While the job description includes the title position, responsibilities and summary, the specification identifies the skills, traits, education and experience a candidate might need to qualify for that job.

Drawings: are sketches that are used by designers such as architects, engineers and interior designers as a quick and simple way of exploring initial ideas for designs.

A job sheet: is a document that outlines all the relevant information about a job, task, or project. Technicians use the information on the sheet to start a job and add more information as the job's requirements change along the way.

Work Instructions: are documents that clearly and precisely describe the correct way to perform certain tasks that may cause inconvenience or damage if not done in the established manner.

Self-Check – 1

Test-I Multiple choices

Instruction: Select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

1. In which departments, Standard operating procedures can maintain safety and its efficiency?
 - A. Production /operations
 - B. Sales and customer service
 - C. Employee training
 - D. Financial
 - E. All
2. _____ is the state of being in accordance with established guidelines of work health and safety or specifications, or the process of becoming so.
 - A. Compliance with work health and safety

- B. Standard operating procedures
 - C. Personal protective equipment
 - D. All
3. _____ is anything that has the potential to cause harm.
- A. Good safety
 - B. Enough skill
 - C. Enough knowledge
 - D. Hazard
4. In which measures, risks in workplace can be reduced?
- A. Following standard operating procedures
 - B. Using personal protective equipment
 - C. Safe materials handling
 - D. Taking rest breaks E. All
5. Which combination of safety equipment is correct?
- A. Glove for hand D. Goggle for face
 - B. Hat for head E. All except D are correct
 - C. Boot for stomach

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 10 minute for each question and each point has 4Points.

1. What are the two basic problems in wearing eye and face protectors in observing personal protection?

Note: Satisfactory rating – 8% and above points Unsatisfactory - below 8% points

You can ask you trainer for the copy of the correct answers.

Page 13 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
---------------	--	---	----------------------------

Unit Two: Weighing

This unit to provide you the necessary information regarding the following content coverage and topics:

- Identifying and taking fibres, yarns, fabrics, dyestuffs, chemicals and auxiliaries samples
- Organizing weighing or measuring equipment.
- Checking calibration

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify and take Fibres samples, yarns, fabrics, dyestuffs, chemicals and auxiliaries to be weighed.
- Organize appropriate weighing or measuring equipment.
- Check calibration as required.

2.1 Identifying and taking fibers, yarns, fabrics, dyestuffs, chemicals and auxiliaries samples

Identifying and taking fibers samples:

The identification of textile fibers is a task frequently performed in a textile laboratory. The need to identify fibers arises in fibers research as well as during fabric production and processing. Identification tests are performed by utilizing tests that take advantage of the different chemical and to some extent physical characteristics of fibers. Different tests are used to identify and take fibers sample. These tests include:

a) **Burning test:**

Different fibers have different chemical structures. Based on the chemical structures, the fibers exhibit stronger or weaker intermolecular bonding, which in turn affects the melting and burning behavior. For example cellulosic fibers have strong intermolecular hydrogen bonding which do not allow them to soften or melt before thermal degradation temperature is reached. On the other hand thermoplastic fibers melt and thus shrink to form bead as they approach the flame.

Another very important characteristic used for identification in the flame test is the odor produced during the burning of the fibers e.g. vegetable fibers and regenerated cellulose smell like burning paper, natural protein fibers, wool and silk produce a burning hair odor. The man made fibers such as acrylic, nylon, and polyester have characteristic odor, which can be recognized with experience.

Page 15 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
---------------	--	---	----------------------------

The burning behavior is a good preliminary test to categorize fibers into generic groups. However, this test cannot be used alone to provide exact identification of specific fibers.

b) Elemental analysis:

Wool consists of polypeptide chains and these chains are interconnected through -S-S- (cystine linkages). Among all the linkages present in wool such as hydrogen bonds, salt linkages, and cystine linkages, the cystine linkages are the weakest and especially very sensitive to attack by alkalis. Therefore, the treatment with alkali breaks these cystine linkages and the addition of lead acetate to this solution leads to the formation of PbS, which is brown- black in color thus giving an indication of the presence of sulfur in the wool.

Nylons are polyamides, which contain nitrogen in amide linkages. These amide linkages are also sensitive to attack by alkalis at high temperature. When the fibers are treated with alkali the amide linkages break and ammonia is released which turns red litmus blue.

Polyvinyl chloride is a polymer of chlorine containing monomer (vinyl chloride). When heated, HCl gets liberated. This HCl when comes in contact with Cu (in flame), it forms copper chloride, leading to green coloration in the flame.

c) Solubility test:

The differences in the chemical structure of various textile fibers affect their solubility and reactivity towards solvents. These differences in solubility and reactivity can be used to distinguish the fibers belonging to the same class.

For example, it may not be possible to distinguish between wool and silk by burning behavior alone, since both produce the same smell of burning. However, when treated with concentrated hydrochloric acid for 15 min., silk dissolves while wool does not.

The main groups of textile fibers are: protein, cellulose, and manmade fibers. All these fibers are dyed in a wide range of colors, with various fastness properties, for a multitude of different textile products. Each type of fiber requires specific types of dyes and dyeing methods.

Identifying and taking yarns:

There are at least four ways to identify yarns from one another. These may include:

a) Inspecting yarn's appearance and texture

This can be done by different techniques. These include: Running your fingers along the loose piece of the yarn, Shine a light on the yarn to see if it is reflective, Soak the yarn in hot water to see if it has an animal smell. Example: Cotton feels much softer and smoother than something like wool, most animal products look dull and dark and animal-based wool smells like animal hair.

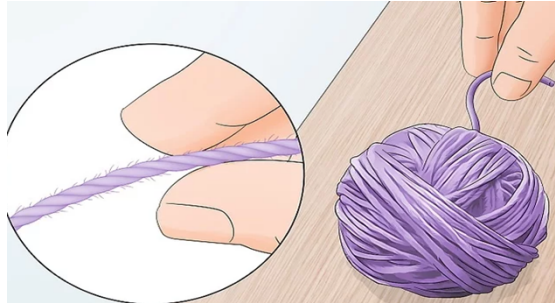


Figure 2.1: Inspecting yarn's appearance and texture

b) Performing a felting test

Felting is fusing pieces of yarn together by hand. It can't be done with most types of yarn, so it's useful for recognizing wool and other animal products. Cut the sample into two and then fuse it.

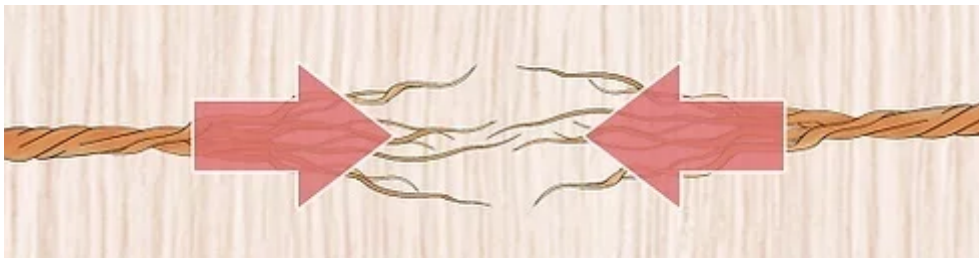


Figure 2.2: felting test

c) Burning a yarn sample

After holding yarn sample with tweezers; ignite it and closely observe its flame and odor. Plant-based yarn smells like burning wood, while animal-based yarn smells like burning hair. Synthetic yarns are the easiest to distinguish, since most types smell particularly nasty.

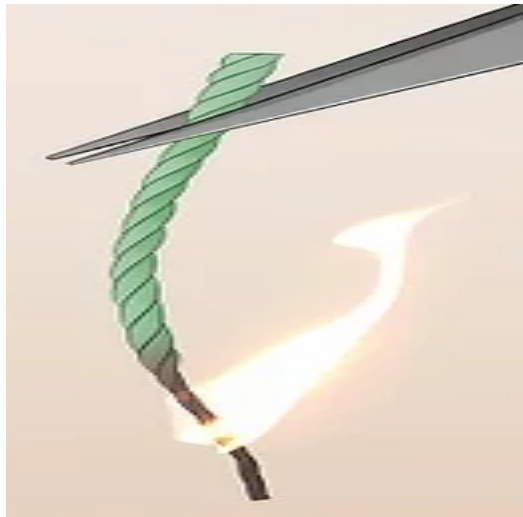


Figure- 2.3: Burning yarn

d) Dissolving yarn in chemicals

The bleach test is great for telling you what kind of yarn you have, but not what specific type. For example, you won't be able to tell apart wool and alpaca hair without inspecting them on your own. Choose regular chlorine bleach rather than a color-safe alternative.

In general, Plant and synthetic fibers don't dissolve at all, but lose their color completely. Animal-based yarn, such as wool, dissolves over time.



Figure 2.4: Dissolving yarn in chemicals

Identifying and taking fabric samples:

Different methods are used to identify fabric structures. These may include:

a) Fabric burn test:

The fabric burn test is done to determine a fabric material of unknown origin. Some fabrics ignite and some melt. Burn test fail to distinguish between cotton and other cellulose fibers.

Different types of fabric burn differently; cotton burns with a yellow flame and a smell reminiscent of leaves, while acrylic smells acidic and melts. Pay attention to:

- The smell of the fabric as it burns
- The color of the smoke
- How quickly the fabric burns or if it melts or doesn't burn at all
- The resulting ash

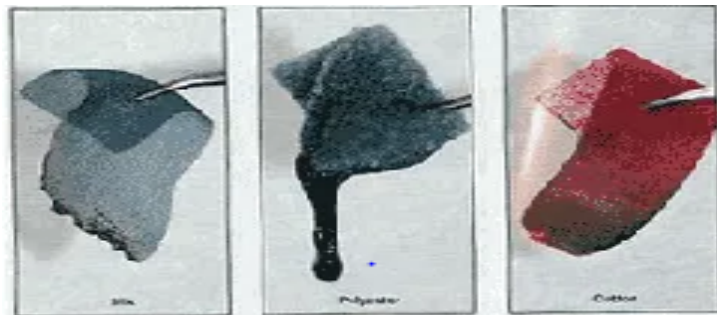


Figure 2.5: Fabric burning test

b) Using a Microscope:

Different fabric structures can be seen observed under microscope. These fabric structures may be plain, twill, sateen/satin, single jersey, polo and etc. Compare what you see to pictures of different types of fabric magnified.

Identifying and taking Dyestuffs samples:

Different dyestuffs are available in textile chemical processing unit. These dyestuff samples can be identified and taken based on their requirements. Textile chemical processing dyestuffs include: Direct Dyes, Reactive Dyes, Basic Dyes, Acid Dyes, Mordant or Chrome Dyes, Disperse Dyes, Vat Dyes, Sulphur Dyes, Azoic Dyes or Naphthol Dyes, Pigment Dyes, Optical Brightners and etc. Some of their descriptions explained as below.

a. Direct Dyes:

Direct dyes are a relatively inexpensive and easy way of dyeing natural cellulose fibers like cotton and regenerated cellulose fibers like viscose and rayon. Although they do not have good fastness to washing or other wet processes. Hydrogen bonding and Van der Waals forces help bind the dye to the fiber. Fastness properties may be improved by after treatment- a post dyeing chemicals.

b. Reactive Dyes:

Reactive dyes form strong Covalent bonds with cellulosic fibers like cotton and regenerated cellulosic fiber like viscose, rayon. The formation of the covalent bond between dye and fiber means reactive dyes give extremely high wash and wet fastness properties.

c. Vat Dyes:

Vat dyes are used to dye cotton and viscose, rayon. Vat dyes are insoluble and so cannot penetrate the fibers in solution. They can however be reduced to a soluble form called the leuco form in the presence of alkali and a reducing agent. Vat dyeing is a multistage process. The leuco molecules are then oxidized to be insoluble once more and develop the color inside the fiber. Vat dyes have excellent wash fastness properties but the color range is more limited and more expensive. Sulphur dyes are similar to vat dyes but are cheaper, less environmentally friendly and are limited to flat dull colors.

d. Azoic Dyes:

Azoic dyes are applied to cotton and viscose, rayon. The textile is impregnated with a naphthal based, coupling compound and immersed in a dye bath containing a diazotised base triggering a precipitation reaction. The color is manufactured inside the fiber by the coupling of the two components. Since the dye molecules are large and insoluble, they have excellent wash fastness properties. Poor rub fastness can be a problem due to dye formation on the textile surface. Insufficient after washing will give poor fastness to wet treatments.

e. Acid Dyes:

Acid dyes have a direct affinity for protein fibers and are the main class of dyestuff for dyeing wool. Nylon also has an affinity for acid dyes. The attraction between dye and fiber is the result of negatively charged dye particles called anions associating with positively charged basic groups in the fiber generally under acid conditions.

f. Disperse Dyes:

Disperse dye are applied to Polyester. Polyester has a lightly packed molecular structure called a crystalline structure. It is hydrophobic or water heating. Heat opens up the crystalline structure to allow disperse dye molecules to enter the fiber from solution where they have been held in suspension. The dye is trapped in the fiber upon cooling and held by physical

forces to produce good fastness properties. Disperse dyes may be applied at elevated temperatures from pressurized vessels or at the boil with the assistance of a chemical called a carrier.

g. Basic Dyes:

Acrylic fibers are dyed with the brilliant and intense modified basic dyes. Basic dyes are positively charged or cationic. These positively charged cations are attracted to negatively charged anions in the acrylic fiber. The reaction of the cation and anion form salt linkages and the fiber is colored with good wash and light fastness properties.

Identifying and taking chemicals and auxiliaries samples:

There are different types of chemical used in textile dyeing which are pointed in the below according to their types:

- a. Basic chemicals:** Soda ash, Hydrochloric, Hydrogen peroxide, Sulphuric Acid Acetic Acid, Formic acid, Caustic soda.
- b. Washing agent or soaping agent:** Serafast-CRD, Kappatex R98, Seraperse CSN, Crosden LPD, ResotexWOP, Diypol XLF (For polyester fabric), Jintex WRN.
- c. Detergent and scouring agent:** Jintex-GD, Felosan RGN, Jintex-GS.
- d. Leveling agent:** Levelex-P, inleve leve-RSPL, Serabid- MIP, Dyapol XLF, Lubovin-RG-BD.
- e. Salt:** Common Salt, Glauber Salt.
- f. Sequestering agent:** Resotext 600S, Heptol-EMG, Heptol-DBL.
- g. Whitening agent:** Uvitex2B, Uvitex BHV, Bluton BBV, Tuboblanc col, Uvitex BAM, Synowhite, Hostalux ETBN (For polyester fabric).
- h. Fixing agent:** Sandofix EC, Tinofix-ECO, Protefix-DPE-568, Jifix –SR, Optifix-EC.
- i. Softener:** Cetasaft CS, Resomine Supper, Acelon, Resosoft –XCL, Silicon (For Finishing).
- j. Bleaching agent:** 35 % H₂O₂
- k. Reducing agent:** Hydrose.
- l. Stabilizer:** Stabilizer PSLT, kappazon H53, STAB, Tinoclarite CBB.
- m. Enzyme:** Tinozyme 44L, Rzyme 1000, Avozyme CL PLUS, Enzyme-B50.
- n. Anticreasing agent:** Kappavon CL, Biovin 109, AC-200, Cibafuid – C, MFL.

- o. Antifoaming agent:* Jintex TPA, AV-NO, VO, Cibaflo-JET.
- p. PH controller:* Soda Ash, Acid, Caustic, Neutracid RBT (Nonvolatile).

2.2 Organizing weighing or measuring equipment

Weighing is an important operation in gravimetric analysis. Usually it involves the use of an electronic balance with a minimum readability of 0.1 mg. In order to ensure reproducible results, sample handling is very critical especially when hygroscopic materials are weighed. For most textile materials, an accurate weighing result can only be obtained by repeated heating–cooling–weighing until a constant weight is reached. During the weighing operation, the samples to be weighed must be considered first.

Measuring equipment may include:



Figure 2.6: Weighing balances

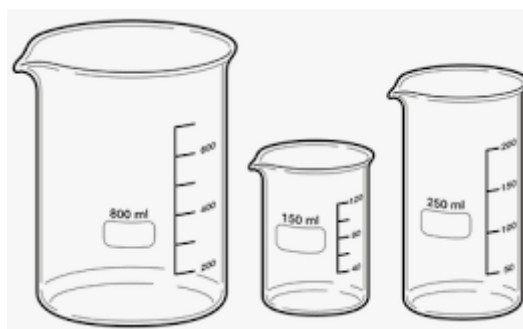


Figure 2.7: Beakers

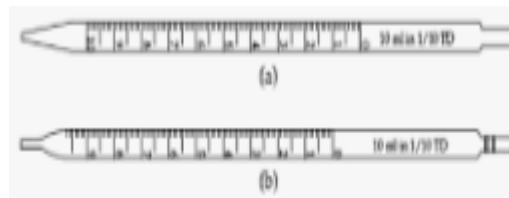


Figure 2.8: Pipette

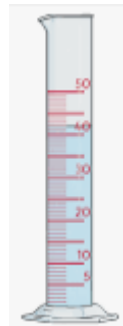


Figure 2.9: Measuring cylinders



Figure 2.10: Flasks



Figure 2.11: PH meter

2.3 Checking calibration

Calibration is the process of configuring an instrument to provide a result for a sample within an acceptable range. A calibration process starts with the basic step of comparing a

known with an unknown to determine the error or value of the unknown quantity. However, in practice, a calibration process may consist of "as found" verification, adjustment, and "as left" verification.

Calibrations are performed using only a few calibrators to establish the correlation at specific points within the instrument's operating range. Many measurement devices are adjusted physically (turning an adjustment screw on a pressure gauge), electrically (turning a potentiometer in a voltmeter), or through internal firmware settings in a digital instrument.

Eliminating or minimizing factors that cause inaccurate measurements is a fundamental aspect of instrumentation design.

There are two common calibration procedures: using a working curve, and the standard-addition method. Both of these methods require one or more standards of known composition to calibrate the measurement.

The chief advantage of the working curve method is that it is rapid: a single set of standards can be used for the measurement of multiple samples. The standard-addition method requires multiple measurements for each sample, but can reduce inaccuracies due to interferences and matrix effects.

Steps to follow instrument calibration:

Option-A

- a. Identify the measuring device
- b. With nothing on the pan, set to zero by pressing the "on" button.
- c. Select the unit of measurement
- d. Place weighing bottle or vial on balance and set to zero again.
- e. Transfer sample into container slowly, until you reach the desired mass and then write down the result.

Option-B

- a. Identify the measuring device
- b. Select the unit of measurement
- c. With nothing on the pan, set to zero by pressing the "on" button.
- d. Place the sample on to weighing balance slowly, until you reach the desired mass and then write down the result.

Self check-2

Part-I: Multiple choices

Instruction: Select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

1. Which fiber testing method is used to identify type of element present in its composition?
 - A. Burning test
 - B. Elemental analysis
 - C. Solubility test
 - D. All

2. One of the following techniques is used to identify and take yarns for further textile chemical processing?
 - A. Inspecting yarn's appearance and texture
 - B. Performing a felting test
 - C. Burning a yarn sample
 - D. Dissolving yarn in chemicals
 - E. All

3. _____ is fusing pieces of yarn together by hand while identifying and taking yarn sample for textile chemical processing.
 - A. Inspecting yarn's appearance and texture
 - B. Felting test
 - C. Burning a yarn sample
 - D. Dissolving yarn in chemicals

4. Why odor of cotton is like that of burning paper?
 - A. Because is manmade fiber
 - B. Because it is protein fiber
 - C. Because it is cellulosic fiber
 - D. None of the above

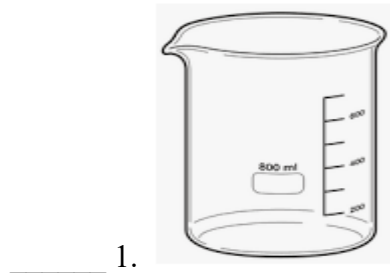
5. Which method of fabric identification is used in order to determine fabric structure?
 - A. Fabric burn test
 - B. Using a Microscope
 - C. Counting thread density
 - D. All

Part- II: Matching

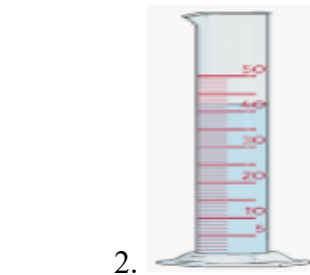
Instruction: Match column “A” with “B”. You have given 1 Minute for each question. Each question carries 2 Point.

Column -A

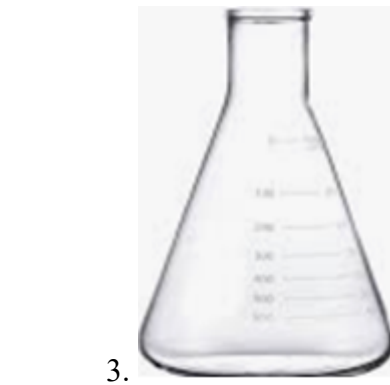
Column -B



A. Beakers



B. Measuring cylinder



C. Flask



D. PH Meter

E. Pipette

Note: Satisfactory rating – 10% and above points Unsatisfactory - below 10% points

You can ask you trainer for the copy of the correct answers.

Operation sheet-2

Operation Title: Identifying and taking fiber samples by burning test

Page 27 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
---------------	--	---	----------------------------

Purpose:

- To study the reaction of fibers to heat and flame
- To identify textile fibers by burning test

Instruction: Conduct burning test and record result for fiber samples according to the given burner. You have given 1hr for the task.

Equipment, Tools & materials: a pair of tongs and burner, different fiber samples.

Operation procedures:

1. Hold a small bunch /tuft of fibers in the pair of tongs and gradually move it towards the flame (from the side, without taking it inside the flame). Observe the behavior of the fiber as it approaches the flame i.e. whether it fuses, shrinks or curls away from the flame.
2. Take another such sample and hold it in the tongs. This time bring the fiber inside the flame so that it starts burning. Note how it burns in the flame i.e. whether it burns slowly or quickly, if any melting takes place with burning, etc.
3. Note how the sample behaves after it is removed from the flame and observe if it is self-extinguishing or not.
4. After burning, observe the characteristics of the ash or the bead produced. Note the brittleness, shape and color of the bead.
5. Also note down any important characteristics you observe which can be used for fiber identification.
6. Take known samples of various fibers and note their burning characteristics and compare with the table provided to you.

Table 2.1 Burning Characteristics of textile fibers

Fiber	When Approaching Flame	When in Flame	After Removal from Flame	Odor	Typical Ash Characteristics
Cotton	Does not fuse or shrink	Burns quickly without melting	Continues to burn without melting	Burning paper	Small, fluffy, gray ash
Natural silk	Fuses and curls away from flame	Burns slowly with some melting	Burns very slowly, sometimes self extinguishing	Burning hair	Round, black bead, brittle, pulverizes easily
Wool	Fuses and curls away from flame	Burns slowly with some melting	Burns very slowly, self extinguishing	Burning hair	Irregular blistered ash, brittle, breaks easily
Rayon	Does not shrink away from flame	Burns without melting	Continues to burn without melting	Burning paper	Small or no ash
Acetate	Fuses away from flame	Burns rapidly with melting	Continues to burn with melting	Acetic acid or vinegar	Leaves brittle, black irregular shaped bead
Acrylic	Fuses away from flame	Burns rapidly with melting	Continues to burn with melting	Acrid	Leaves hard brittle, black irregular bead

Modacrylic	Fuses away from flame	Burns slowly with melting	Self extinguishing	Acrid	Leaves a hard, black irregular shaped bead
Nylon	Fuses and shrinks away from flame	Burns slowly with melting drips	Usually self extinguishing due to melt dripping	Leaves a hard, tough, gray round bead	Round brittle, hard, black bead
Olefin	Fuses, shrinks and curls away from flame	Burns with melting	Continues to burn with melting	Chemical	Leaves a hard, tough bead
Polyester	Fuses and shrinks away from flame	Burns slowly with melting	Usually self extinguishing due to melt dripping	Sweet aromatic	Leaves a hard, tough, round black bead

Quality criteria:

- Use only a small amount of sample in a tuft form and keep the fibers straight in nearly parallel form for observations when approaching the flame.

Precautions:

- The fiber samples should be dry so that it does not modify the fiber properties when subjected to flame test.

LAP TEST-2

Instructions: Perform the following activities. You have given 1hr for each task. Each question carries 5Points.

Task-1. Identify and take fiber samples by burning test for textile chemical processing input.

Task-2. Request your instructor for evaluation & feed buck.

Unit Three: Textile chemical processing inputs weighing

This unit to provide you the necessary information regarding the following content coverage and topics:

- Weighing Fibers, yarns, fabrics, dyestuffs, chemicals and auxiliaries
- Recording and Documenting weights

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Weigh fibers, yarns, fabrics, dyestuffs, chemicals and auxiliaries accurately.
- Record and document weights correctly.

3.1 Weighing Fibers, yarns, fabrics, dyestuffs, chemicals and auxiliaries

Weighing (using a weighing scale) is an entirely acceptable way of measuring or measuring mass of the textile fiber, yarn or fabric, dyestuffs, chemicals and auxiliaries.

A device used to measure weight or mass is known as beam balance. These are also known as mass scales, weight scales. The system is made up of a weigh scale indicator. There are different weighing instruments. These may include:



Figure 3.1: Dial - O - Gram Mechanical Balance



Figure 3.2: MT Microbalance



Figure 3.3: Electronic Torsion Balance

Each weighing instrument has its own working procedures. Before weighing any textile samples, weighing device must be calibrated first. Calibration is the process of testing the scale, to ensure the level of accuracy you require. In a laboratory setting, results are dependent upon exact scale calibration. An inaccurate scale could significantly hurt your results. Incorrect measurements could result in product quality issues or scrapped batches. The most common practice is the following: start with zeroing the instrument without any load.

Weighing of textile materials, dyestuffs, auxiliaries and chemicals incorporates the following activities:

- a) Preparation of the instruments
- b) Sample of the fiber/yarn/fabric/dyestuff/chemicals and auxiliary is ready for test
- c) Operation of the instruments
- d) Examine and Record the results

3.2 Recording and Documenting weights

Weights data can be recorded in different ways. This may be: manually or electronically. In the case of electronically; connect your scale to Personal Computer and recording the weight should not be a difficult task.

Simple Data Logger (SDL) writes the weight received from a scale or balance to a file, optionally adding the date and time. The generated by SDL can easily be opened in Excel and other spreadsheet applications for further processing and visualization.

If your scale or balance is listed in SDL, simply select it and press the set default parameters for device button. Otherwise, select generic measuring instrument and enter the interface parameters manually. Set the radio button to match your connection: specified a terminator (a.k.a. delimiter, the last character your scale sends in each line of data) or a timeout (e.g. 100ms, SDL will process received data if no additional data is received during this time).

Documentation helps to build up a detailed picture of what a manufacturing function has done in the past and what it is doing now and, thus, it provides abases for planning what it is going to do in the future.

Self check-3

Test-I Multiple choices

Instruction: Select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

1. Which method is used to record weight data?
 - A. Manually
 - B. Electronically
 - C. A and B
 - D. None

2. Which instrument is used to measure textile sample weight?
 - A. Dial - O - Gram Mechanical Balance,
 - B. MT Microbalance
 - C. Electronic Torsion Balance

3. Which type of textile chemical processing input is measured on weighing instrument?
 - A. Fibers
 - B. Yarns
 - C. Fabrics
 - D. Dye stuffs, chemicals and auxiliaries
 - E. All

4. Which activity is incorporated during textile chemical processing input measurement?
 - A. Preparation of the instruments
 - B. Ready samples for test
 - C. Operation of the instruments
 - D. Examine and Record the results
 - E. All

Note: Satisfactory rating – 5% and above points Unsatisfactory - below 5% points

You can ask you trainer for the copy of the correct answers.

Operation sheet-3

Operation Title: Weighing Textile Sample

Purpose: To weigh fabric sample

Instruction: weigh and record fabric samples according to the given weighing procedures. You have given 1hr for the task.

Equipment, Tools & materials: Scissors, Dial - O - Gram Mechanical Balance or MT Microbalance or Electronic Torsion Balance, meter, textile samples, dyestuff, chemical and auxiliaries and etc.

Operation procedures:

Option-(A):

Dial - O - Gram Mechanical Balance instrument weighing procedure:

1. Slide all poises to their respective zero positions.
2. Turn the dial to zero positions. You can now zero the balance by rotating the knurled compensator knob at the left end of the beam until the pointer on the right up to zero.
3. Move the 200g poise on rear beam to the first notch, which cause the pointer to drop, and then move it back one notch for the pointer to rise.
4. Repeat this procedure with the 100-gram poise.
5. Turn the knob slowly until the pointer is exactly centered on zero indicators.
6. The weight of the specimen is the sum of the values of poise positions, the dial position and vernier reading.

Option-(B):

MT Microbalance instrument weighing procedure:

1. By pressing the ON/OFF key switch the balance from standby to the weighing mode. Here the model designation and the software version are briefly displayed and all display segments light up for a short space of time.
2. Load the weighing sample using tweezers and press the print key. The fully automatic door function closes the draft shield. The triangle symbol (print symbol) and circle symbol of the

stability detection (ASD) appear in the display. When the symbol of the stability detection fades, the warning beep sounds, the triangle symbol also fades and the draft shield opens.

3. Automatically read off the weighing result.
4. For switching off the balance, lift up ON/OFF key briefly from below. This closes the draft shield automatically if the fully automatic door function is switched on otherwise, close the draft shield manually to prevent the ingress of dust and dirt.

Option-(C):

Electronic Torsion Balance instrument weighing procedure:

1. Place the balance on a rigid, horizontal and vibration free support, away from air draughts and heat sources.
2. Connect the instrument to the power supply.
3. Connect the power supply to 220V line. Now the instrument is ON and the display shows a message formed by a letter followed by numbers. After about 2 seconds the instrument shows HELL o. The display then makes a display efficiency test as segment starts flashing - 888880.
4. After the automatic zero setting the instrument is ready for use.
5. Before starting operations allow the instrument a 15 minutes warm up time.
6. In case of urgency press the TARE key and put the object on the pan. Repeat this operation several times and verify that the value is always the same.
7. Always leave the instrument ON during the working day. By using the ON/OFF key it is possible to turn off the display. In this way the instrument is always ready to use without the warm up period.
8. When an object is put on the pan, the display shows its mass value. If this value is higher than the capacity of the balance the display shows a flashing message -HI-.
9. If for any reason the pan is not correctly positioned, display shows flashing message -L0-.

Quality criteria: Ensure the weights are within 0.001gm up to 0.01gm acceptable tolerance level. Fabric samples being taken at every 25 centimeters across the width of the fabric. Average/mean reading is used.

Precautions: Weighing device must be calibrated first; pan surface must be cleaned and oils on your hands must be cleaned since can alter the weights.

Operation of the different balances used in the experiment must be understood from its manual.

LAP TEST-3

Instructions: Perform the following activities. You have given 1hr for each task. This task carries 5Points.

Task-1. Weigh textile materials, dyestuffs, chemicals and auxiliaries samples.

Task-2. Request your instructor for evaluation & feed back.

Unit Four: Textile chemical processing inputs checking

This unit to provide you the necessary information regarding the following content coverage and topics:

- Checking inputs quality
- Checking raw materials weight

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Check inputs correctly for purity, color, blend etc., if appropriate.
- Check the weight of raw materials against production order.

4.1 Checking inputs quality

Different textile chemical processing input has different quality. These qualities may be seen from its purity, color quality, blend and etc.

a) Purity:

One of the purity to be checked is fiber purity or cleanliness, i.e. the absence of defects and impurities is of high importance. It influences the textile chemical processing and the quality of obtained yarn. Fibers of different kinds contain various defects and impurities.

Natural fibers defects includes: fiber strings (tails), combined strings, immature fibers, immature seeds, crushed seeds, bearded notes, neps. Synthetic fiber defects includes: gluing, coarse fibers, horny fibers, skitter ness, friability etc.

Faults have admissible limit standards according to the harmful defects present. There are two methods of determining impurities and faults in cotton fiber: these are: hand sorting and using trash analyzer. Shirley cotton analyzer is an instrument used for determining the amount of faults and impurities for cotton fiber. When we compare with hand sorting method this takes time less for making the test but gives total defects without division.

b) Color:

There are a variety of instruments available for the measurement of color within the textile samples. This may include: colorimeter, spectrophotometer and others.

Colorimeters instruments:

It was the pioneers of color measuring instruments. Colorimeters view a sample through at least three filters measuring the quantity of light reflected from the sample and passed through each of the filters.

The filters were originally designed to mimic the response of the red, blue and green cones of the eye as closely as possible. Deficiency of colorimeters is unable to detect if an object's color will appear differently under different light sources. Therefore, colorimeters have limited capability when compared with current technology.

Page 43 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
---------------	--	---	----------------------------

In color processing industries it is very important to reproduce the same color consistently without shade or hue variation and it is equally important to formulate color for a given colored sample as received from a customer for reproduction.

c) Blend:

In this case, various lots of fibers are mixed together and have homogeneous mass. Example: cotton fibers may be blended with polyester. If these two fibers blend together unknowingly, it has its own impact on the next textile chemical processing. Fibers present in a blend can be determined by means of the different identification procedures

4.2 Checking raw materials weight

Prior to the manufacturing process, raw materials can be inspected to identify if the materials themselves meet specifications. During the manufacturing process, products are also inspected at the factory to verify that quality and quantity requirement and specifications are being met.

The accurate weighing of raw materials according to the formulation for a given ratio is perhaps the most important unit operation involved in feed manufacture.

Yarn weight can be checked by handy little knitting secret called WPI (warps per inch)

Step 1: Warp the yarn around a pencil not tightly.

Step 2: Once you have warped your yarn, count the number of times it loops around the pencil within the first inch.

Step 3: Then, compare that number with the numbers on the WPI chart. Yarn have different weights WPI chart

Table 4.1: Weights WPI chart

Yarn weight	Warp per inch	Gauge
0 lace weight yarn	>35	>8.5sts/inch
1-fingering weight yarn	19-22	7--8 sts/inch
2- sport weight yarn	15.-18	5.75--6.5 sts/inch
3-DK weight yarn	12-14	5.5 --6sts/inch
4-worsted weight yarn	9-11	4--5 sts/inch
5- bulky weight yarn	7-8	3--3.75 sts/inch
6-super bulky weight yarn	<6	1.5—3sts/inch

Self check-4

Test-I Multiple choices

Instruction: Select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

- 4.2.1.1 Which instruments is used in measuring color quality in textile samples?
- Colorimeter
 - Spectrophotometer
 - Digital balance
 - A and B
5. Which quality parameters of textile chemical processing input must be checked?
- Purity
 - Color
 - Blend
 - All
6. Which is type of natural textile fiber defects?
- Immature fibers
 - Immature seeds
 - Crushed seeds
 - Neps. E. All
7. Which one is the function of Reflectance Spectrophotometer?
- Color difference measurements
 - Recipe prediction parameters for colored samples and shade library's
 - Calculating strength value
 - A and B are correct

Note: Satisfactory rating – 5% and above points Unsatisfactory - below 5% points

You can ask you trainer for the copy of the correct answers.

Page 47 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
---------------	--	---	----------------------------

Operation sheet-4

Operation Title: Checking blend fiber sample

Purpose: To analyze fibers present in a blend by means of the different identification procedures

Instruction: Check blend fiber sample according to the given procedures. You have given 1hr for the task.

Equipment, Tools & materials: Tongs, test tubes, test-tube stands, beakers, hot water-bath at 60°C, burner, acetone in wash bottle, distilled water, sintered glass funnel with filtration assembly and unknown fiber blends.

Operation procedures:

1. Start with at least 0.1-0.2 gm of unknown sample for dissolution.
2. Place the sample in the first reagent at recommended conditions and treat ({10gm Calcium Chloride in 100ml of 90% Formic Acid}, {45ml Hydrochloric Acid Solutions +55ml of water}, {Sodium Fusion Test}, {Sodium Hypochlorite Solutions}, {250ml of Sulfuric Acid + 320ml of water} and {Sodium zincate = 300gm of NaOH +400ml of water + 150gm of zinc oxide}.
3. Separate any residue that is left by decantation or filtration.
4. Rinse carefully with distilled water, then with acetone and dry before proceeding to next step. The amount of material left should be observed very carefully for partial dissolution (dissolution of one component). The partial dissolution can also be crosschecked by weighing the residual fiber along with sintered glass funnel after drying.
5. Record the results of each step carefully. Place the residue in the next reagent and repeat the steps.
6. Repeat the above procedure, on the residues until the total sample has been destroyed or put through every test.
7. Analyze the unknown fiber samples, and write your observations.

Quality criteria: Ensure the weighing instruments are calibrated for all substrate and chemical recipe.

Page 48 of 56	Ministry of Labor and Skills Author/Copyright	Weigh and Check Textile chemical processing inputs	Version -1 August, 2022
---------------	--	---	----------------------------

Precautions:

- All the tests are to be done in the given order; otherwise the results may be confusing. Many fibers can dissolve in solvents appearing later in the sequence such as sulfuric acid.
- Before doing any test first, make sure the test-tube is clean and dry. Wash the test tube with water and then with acetone. Dry the test tube over a flame; make sure that hardly any acetone is present in the test tube when you heat it as acetone catches fire.
- Never add water directly to a conc. solution of sulfuric acid as it can cause an explosion.
- Do not contaminate stock solvents by using pipette/droppers from other solvent bottles. Avoid using same droppers for different concentrations of same chemicals (even in sulfuric acid solutions).
- Immediately replace the lids of the chemical containing bottles after taking the required amount of chemicals.
- Chemicals giving out fumes or strong odour must be used under the ventilated hood.

LAP TEST-4

Instructions: Perform the following activities. You have given 1hr for each task. Each question carries 5Points.

Task-1. Check blend fiber sample.

Task-2. Request your instructor for evaluation & feed back.

Unit Five: Documentation

This unit to provide you the necessary information regarding the following content coverage and topics:

- Checking inputs documentation

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Check textile chemical processing inputs; weight, color, order details and others parameters against relevant documentation.

5.1 Checking inputs documentation

Textile manufacturing is complicated. So, before manufacturing and processing any textile chemical processing products, company have to receive an order for a finished product. In order to give the customer what they want, your company has to order the appropriate raw materials.

Production orders from different customers should have to be documented. There may be different types of orders. It may be yarns of different counts, fabrics of different quality and quantity, different dyestuff, chemicals and auxiliaries and etc.

One of the most important factors for textile industry is proper documentation. A perfect documentation system can help you to finish the whole process properly without any problem. So that we need to understand all textile departments documentation properly.

The other important documentation during production includes:

- Proper order confirmation and documentation.
- Daily production report and
- Daily quality report

Self check-5

Part I: Short answer writing

Direction: Give short answer to the following questions. Time allotted is 10minute and it carries 6 point.

1. List and discuss different types of textile chemical processing input documentation during production.

Note: Satisfactory rating – 4% and above points Unsatisfactory - below 4% points

You can ask you trainer for the copy of the correct answers.

References

1. J. Gordon Clock: Hand Book of Textile Fibres, Volume I: Natural Fibres, 1993.
2. J. Gordon Clock: Hand Book of Textile Fibres, Volume II: Man Made Fibres, 1993.
3. A. K.Agrawal & M. Jassal: Textile Fibres: Laboratory manual, 2001.
4. N. Shernysheva: Laboratory Practice in the Study of Textile Materials, 1989.
5. S.B. Warner: Fibre Science, 1995.
6. E.B. Grover & D.S. Hamby Handbook of Textile Testing and Quality Control, 1993.
7. <https://www.chemicool.com/definition/calibration.html>
8. <https://www.aicompanies.com/education-training/calibration/what-is-calibration/>
9. <https://www.fibre2fashion.com/industry-article/177/fabric-identification>

Participants of this Module (training material) preparation

No	Name	Qualification (Level)	Field of Study	Organization/ Institution	Mobile number	E-mail
1	Tahir Abiyo Diba	A	Textile Technology	Athlete Kenenisa Bekele PTC	+251-910-605550	tahirdiba95@gmail.com
2	Asfaw Azene Ashenafi	A	Textile Technology	Debra-Birhan PTC	+251-913852831	azeneasfaw2008@gmail.com
3	Belachew Andualem	A	Textile Technology	Finote demote PTC	+251- 910694229	Meklt9044@gmail.com
4	Sileabat Gebeyehu Setie	B	Textile Engineering	Nefas meucha PTC	+251 - 918510105	sileabetgebeyehu@gmail.com

