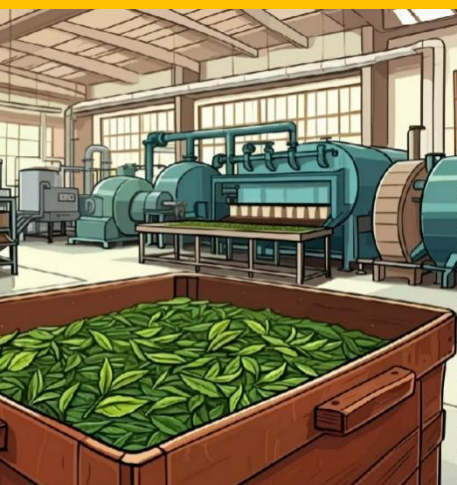




RQF LEVEL 5



FOPTP 503

FOOD PROCESSING

Tea Leaves Processing

TRAINEE'S MANUAL

October, 2024



TEA LEAVES PROCESSING



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ACRONYMS

°C: Degree Celsius

°F: Degree Fahrenheit

ATP: Adenosine Triphosphate

BC: Before Christ

CBT/A: Competence Based Training/ Assessment

CIP: Cleaning in Place

COP: Cleaning Out of Place

CTC: Cut Tear Curl

FDA: Food and Drugs Authority

g: grams

HACCP: Hazard Analysis and Critical Control Point

ISO: International Organization for Standardization

KOICA: Korea International Cooperation Agency

NAEB: National Agricultural Export Development Board

OCIR: Office des Cultures Industrielles du Rwanda

PPE: Personal Protective Equipment

ROI: Return On Investment

rpm: rotation per minute

RTB: Rwanda TVET Board

TQUM Project: TVET Quality Management Project

TVET: Technical and Vocational Education and Training

CTC: Crush, Tear, Curl

INTRODUCTION

This trainee's manual includes all the knowledge and skills required in food processing specifically for the module of "**Tea leaves processing**". Trainees enrolled in this module will engage in practical activities designed to develop and enhance their competencies.

The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainee's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainee, you will start by addressing questions related to the activities, which are designed to foster critical thinking and guide you towards practical applications in the labor market. The manual also provides essential information, including learning hours, required materials, and key tasks to complete throughout the learning process.

All activities included in this training manual are designed to facilitate both individual and group work. After completing the activities, you will conduct a formative assessment, referred to as the end learning outcome assessment. Ensure that you thoroughly review the key readings and the 'Points to Remember' section.

MODULE CODE AND TITLE: FOPTP 503 TEA LEAVES PROCESSING

Learning Outcome 1: Prepare workplace and tea leaves

Learning Outcome 2: Ferment rolled tea leaves

Learning Outcome 3: Dry fermented and steamed tea leaves

Learning Outcome 4: Store graded tea products

Learning Outcome 1: Prepare Workplace and Tea Leaves



Indicative contents

1.1 Introduction on Tea Leaves Processing

1.2 Selecting Tools and Equipment Used in Tea Leaves Processing

1.3 Selecting Materials Used in Tea Leaves Processing

1.4 Cleaning of Workplace

1.5 Receiving Green Tea Leaves

1.6 Steaming of Tea Leaves for Green Tea Making

1.7 Monitoring Withering Conditions of Green Tea Leaves

Key Competencies for Learning Outcome 1: Prepare Workplace and Tea Leaves

Knowledge	Skills	Attitudes
• Explanation of tea leaves. • Identification of tools and equipment used in tea leaves processing. • Identification of materials used during tea leaves processing. • Description of quality characteristics of tea leaves • Description of withering process	• Selecting tools and equipment used in tea leaves processing • Selecting of materials used during tea leaves processing. • Cleaning and arranging of workplace • Receiving green tea leaves • Steaming tea leaves for green tea making • Withering tea leaves for tea making	• Being attentive during selection of materials, tools and equipment used in tea leaves processing. • Being careful during cleaning process • Being honest during receiving tea leaves • Being decision maker during receiving tea leaves • Being careful during arrangement of work place • Being vigilant during withering and steaming condition of green tea leaves



Duration: 20hrs

Learning outcome 1 objectives:



By the end of the learning outcome, the trainees will be able to:

1. Describe clearly tea as a product from tea leaves processing.
2. Identify properly tools and equipment used in tea leaves processing.
3. Select properly tools and equipment used in tea leaves processing.
4. Identify clearly materials used during tea leaves processing.
5. Select properly materials used in tea leaves processing.
6. Clean properly workplace to be used in tea leaves processing
7. Receive correctly green tea leaves to be used in tea leaves processing
8. Describe appropriately quality characteristics of green tea leaves used in tea leaves.
9. Steam correctly tea leaves used during green tea making.
10. Describe properly wither as used in tea leaves processing.
11. Wither effectively tea leaves in tea leaves processing



Resources

Equipment	Tools	Materials
● Weigh bridge or electronic balance ● Mono Rail ● Fan ● Sifter ● Magnet ● Weigh Feeder ● Conveyors ● Rotor Vane ● CTC rollers,	● Thermometer ● Hygrometer ● Trolley ● Green leaf bag ● Brooms ● Spade ● Sorting bins ● Leaf count table ● Tasting cup ● Tasting bowl	● Green tea leaves ● Cleaning agents ● Water ● Source of energy (Electricity, Gas, Firewood (Eucalyptus), Briquette, Peat) ● Packaging material ● Napkin ● Towel

● Fermentation tank ● High pressure washer ● Fluid bed dryer ● Steam boiler, ● Super 3t fiber extractor ● Grading machine ● Packing machine ● Sealing machine ● Air compressor ● Wood split machine ● Rolling table ● Working table	● Tasting spoon ● Kettle ● Bucket ● Moisture meter ● Fork	
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Indicative content 1.1: Introduction on tea leaves processing



Duration: 2 hrs



Theoretical Activity 1.1.1: Introduction on tea leaves processing



Tasks:

1. You are requested to answer the following questions related to tea leaves processing:
 - i. What do you understand by the following terms?
 - a) Tea leaves
 - b) Tea leaves processing
 - ii. What could be the types of tea products?
 - iii. What could be the health benefits of tea?
2. Write the answers to questions on papers, flip chart, Blackboard or white board.
3. Present the findings/answers to the whole class and ask questions where necessary
4. For more clarification, read the **key readings 1.1.1**



Key readings 1.1.1.: Introduction on tea leaves processing

•Definition of key terms

- ✓ **Tea leaves** are the leaves of the **Camellia sinensis** plant, the species primarily used to produce all varieties of tea.
- ✓ **Tea leaves processing** is the series of steps used to transform freshly harvested leaves from the Camellia sinensis plant into the final tea product.

•Background of tea

Tea has been discovered around 2737 BC in China by emperor Shen Nang. He accidentally discovered tea when some leaves from a wild tree blew into his pot of boiling water and it changed the color, flavor and taste.

✓ Spread of tea to other regions

-  Tea was introduced to Japan in the 8th century by Buddhist monks.
-  Tea was also introduced in Europe in the 17th century via Portuguese and Dutch traders.
-  Tea entered Russia and central Asia through trade in the 17th century.

✓ History of tea in Rwanda

- ✚ Tea was introduced to Rwanda during the period of Belgium colonial rule.
- ✚ The first tea plantations were established in the 1950.
- ✚ The first tea factory was built in 1958 at Mulindi.
- ✚ After Rwanda got independence in 1962, Rwandan government established Rwanda tea Authority (**OCIR Thé**) as government agency to oversee the development of tea production.
- ✚ The National Agricultural Export Development Board (NAEB) is now oversee the development and regulation of tea sector.

•List of tea products

✓ Green tea

This is made by **steaming green tea leaves to stop oxidation**, rolling the leaves to express flavor and then heating them to dry. Minimally oxidized leaves, known for their fresh flavor and light color.

✓ Black tea

This is made by drying the green leaves in a process known as "withering" so the leaves become **oxidized (also known as fermented)**, rolling them, and then applying hot air to stop the oxidation process. It is **fully oxidized leaves**, known for their strong flavor and dark color.

✓ Oolong

Also known as red teas take after the black teas in that they are prepared the same way, but with a shorter drying period so the leaves are not as oxidized, or fermented. Partially oxidized leaves, offering a balance between black and green tea flavors.

✓ White tea

It is buds and young leaves with minimal processing, known for their delicate flavor and light color.

✓ Herbal tea

It is also known as a tisane, is an infusion made from a variety of herbs, flowers, fruits, seeds, or roots, rather than from traditional tea leaves (*Camellia sinensis*).

• Health Benefits of Tea

✓ Antioxidants

- ✚ **Protects against cell damage:** Tea is packed with antioxidants, which help neutralize harmful free radicals and prevent cell damage.

✚ **Reduces risk of chronic diseases:** Antioxidants may reduce the risk of heart disease, stroke, and certain types of cancer.

✓ **Heart Health**

✚ **Lowers cholesterol:** Tea consumption help to lower "bad" cholesterol levels.

✚ **Improves blood vessel function:** Tea help to improve blood flow and reduce the risk of blood clots.

✓ **Weight Management**

✚ **Boosts metabolism:** Certain types of tea, like green tea, help to boost metabolism and promote weight loss.

✚ **Reduces appetite:** Tea can help curb appetite, leading to reduced calorie intake.

✓ **Bone Health**

✚ **Increases bone density:** Tea contains compounds that help to improve bone density and reduce the risk of osteoporosis.

✓ **Mental Health**

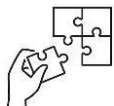
✚ **Reduces stress:** has calming properties that can help reduce stress and anxiety.

✚ **Improves cognitive function:** Tea help to enhance memory and cognitive function.



Points to Remember

- Tea products are processed from tea leaves of *Camellia sinensis* plant and tea leaves are processed into several of tea products like green tea, black tea, white tea, Oolong tea and herbal tea.
- Tea has more health benefits where tea contains various antioxidants like flavonoids and polyphenols that help combat oxidative stress and may reduce the risk of chronic diseases.



Application of learning 1.1.

Visit the nearest tea factory where they are processing tea leaves to observe and document tea product.



Indicative content 1.2: Selecting tools and equipment used in tea leaves processing



Duration: 3 hrs



Theoretical Activity 1.2.1: Identification of tools and equipment used in tea leaves processing.



Tasks:

1. You are requested to answer the following questions related to tools and equipment used in tea leaves processing:
 - i. What could be the tools and equipment used in cleaning?
 - ii. What could be the tools and equipment used in wet processing area during tea leaves processing?
 - iii. What could be tools and equipment used in dry processing area during tea leaves processing?
 - iv. What could be the use of tools and equipment answered in question (i), (ii), (iii)?
2. Write the answers to questions on papers, flip chart, Blackboard or white board.
3. Present the findings/answers to the whole class.
4. For more clarification, read the **key readings 1.2.1**



Key readings 1.2.1: Identification of tools and equipment used in tea leaves processing.

✓ Identification of tools used in tea leaves processing

Type of Tools	image/photo	Uses
Thermometer		A thermometer is used to monitor the temperature in various steps of tea leaves processing
Bucket		✓ Tea leaves are often handpicked and collected in buckets by workers during harvest. ✓ In some small-scale operations, tea leaves are placed in shallow, ventilated buckets to begin the withering process. ✓ Buckets are sometimes used to hold leaves during the oxidation process, ✓ Small quantities of finished tea leaves may be stored in airtight buckets to protect

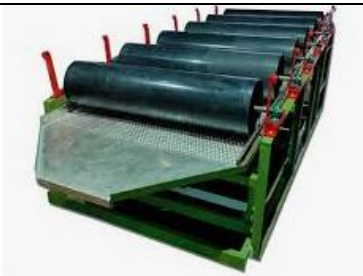
		them from moisture and contamination before packaging or further drying.
• Hygrometer		✓ it measures the relative humidity (RH) of the air. ✓ A hygrometer helps monitor the relative humidity in the withering area, ensuring that the air is dry enough to remove excess moisture from the leaves without causing them to become too brittle or dry too quickly. ✓ A hygrometer helps control the humidity to prevent over-oxidation or under-oxidation. ✓ A hygrometer helps monitor the drying environment, ensuring that the relative humidity is low enough to facilitate moisture evaporation without damaging the quality of the leaves.

• Trolley		✓ Trolleys are used to transport the fresh leaves to the processing factory. ✓ Trolleys are used to transfer the fresh leaves from the collection point to withering troughs or rooms. ✓ After the rolling process, trolleys are used to transfer the rolled leaves to the fermentation room or trays for controlled oxidation.
• Green leaf bag	 	It is used for collecting and transporting fresh tea leaves from the fields to the factory for processing
• Brooms		✓ Brooms are used to keep the processing areas clean by sweeping away tea dust, leaves, and other debris that accumulate

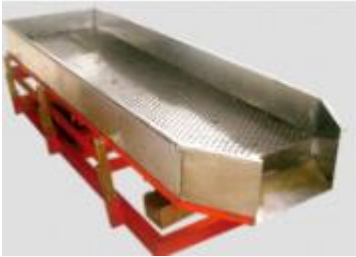
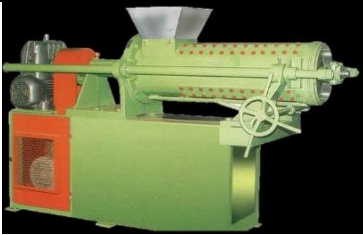
		during various stages of tea processing ✓ Brooms help reduce the risk of slips and falls, creating a safer environment for workers. ✓ After tea leaves are collected, brooms are used to clean the plucking baskets and surrounding areas, ensuring that no residual leaves remain,
• Spade		A spade can be used to mix the leaves in fermentation trays or containers, ensuring that all leaves are exposed to air evenly. A spade can assist in layering the leaves properly within fermentation trays or boxes
• Sorting bins		Sorting bins are used to separate tea leaves based on various quality parameters, such as size, shape, and color. Sorting bins allow workers to easily inspect and sample tea leaves during the sorting process.
• Leaf count table		The leaf count table helps assess the freshness of the received tea leaves by counting the number of young, tender leaves in each batch.

		It allows workers to identify any damaged, wilted, or discolored leaves, which can indicate poor quality
Tasting cup/ Tasting bowl		✓ Tasting cups are used to sample the flavor of freshly received tea leaves. ✓ Tasting cups allow quality control personnel to smell the leaves before brewing, providing insights into the tea's character. ✓ A small amount of tea is brewed in tasting cups to assess the infusion's color, clarity, and overall profile.
Kettle		It involve lightly steaming the leaves in kettles to prevent oxidation before rolling.
Identification of equipment used in tea leaves processing		
Type of equipment	image/photo	Uses

• Weigh bridge		✓ It used to weigh large quantities of raw tea leaves delivered to tea factories. ✓ It helps in ensuring that the processing workflow runs efficiently, and records of the leaf intake are maintained correctly.
• Mono Rail		✓ Monorails are used in the tea industry to transport harvested tea leaves efficiently from the tea gardens to the factory for processing. ✓ Monorail systems within the premises is used to move tea leaves between different stages of processing, such as withering, rolling, fermenting, and drying.
• Fan		✓ Fans are used to circulate air through the leaves, ensuring that moisture evaporates efficiently and uniformly. ✓ Hot air fans are used to blow heated air through the leaves. ✓ Fans provide a gentle air current to cool down the tea quickly without damaging the delicate structure of the leaves ✓ Fans are used in combination with sieves and sorting machines to separate tea

		leaves from dust, fibers, or other unwanted materials	
• Steam boiler		✓ Boilers are used to generate hot air or steam that is circulated around the tea leaves to accelerate the withering process ✓ Steam boilers provide the necessary steam at high pressure and temperature to quickly heat the tea leaves. ✓ Steam boilers generate the heat needed for drying tea leaves uniformly.	
• Super 3t fiber extractor		The Super 3T Fiber Extractor uses mechanical methods to separate fibers and stalks from the actual tea leaves, ensuring a cleaner product.	
• Grading machine		Grading machines separate the processed tea leaves into different grades based on their size. This is done using vibrating sieves or screens with different mesh sizes.M6T	

• Packing and Sealing machine		✓ The packing machine is used to package the final product, which is essential for maintaining freshness, flavor, and aroma. ✓ Packing machines help to seal the tea in airtight containers or bags, ensuring that it remains fresh and retains its aroma until it reaches the consumer.
• Air compressor		✓ Compressed air is often used to clean tea-processing machinery and conveyor belts to remove dust, tea particles, and debris. ✓ Air compressors can be used in the withering process, where fresh tea leaves are spread on large withering troughs.
• Wood split machine		Wood split machines can be employed to split logs into smaller, manageable pieces of firewood,
• Rolling table		The rolling table is to shape the tea leaves and initiate the oxidation process by rupturing the leaf cells, which releases essential oils and enzymes.

Sifter		It is used separating and grading the leaves based on their size and quality.
Magnet		It is used removal of any ferrous or metal contaminants from the tea leaves
Weigh Feeder		The weigh feeder measures the weight of tea leaves entering the processing machinery
Conveyors		It is used to transport tea leaves through different stages of tea leaves processing.
Rotor Vane		It helps to improve the efficiency of leaf maceration and fermentation

• CTC rollers,		✓ Crush: Tea leaves are passed through sharp, serrated rollers that crush the leaves. This breaks down the cellular structure of the leaves, making it easier to extract flavors and essential oils. ✓ Tear: The leaves are torn into smaller pieces as they pass through the rollers. This step increases the surface area, which promotes oxidation and enhances the development of color and flavor. ✓ Curl: After being crushed and torn, the leaves are curled into small, tightly rolled pellets. This creates the distinct look of CTC tea and aids in its fast brewing and strong flavor.
• Fluid bed dryer		Fluid bed dryer circulated hot air through a bed of tea leaves, causing them to float and move in a fluid-like manner.



Practical Activity 1.2.2: Selecting tools and equipment used in tea leaves processing



Task:

You are requested to go in tea leaves processing workshop to select the tools and equipment used in tea leaves processing

- 1: Apply safety precautions.
- 2: Select and adjust the tools and equipment used in tea leaves processing.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 1.2.2 and Ask clarification where necessary
- 5: Perform the task provided in application of learning 1.2.



Key readings 1.2.2: Selecting tools and equipment used in tea leaves processing

• Selection criteria of tools and equipment used in tea leaves processing

- ✓ **Type of tea:** Different types of tea (green, black, oolong, white, etc.) have distinct processing stages. The equipment should be suitable for the specific tea type being processed.
- ✓ **Processing capacity:** The equipment should match the volume of tea leaves to be processed daily or seasonally.
- ✓ **Precision:** Tools must allow for precise control over factors like temperature, humidity, oxidation, fermentation, and drying times.
- ✓ **Automation and scalability:** Depending on production needs, equipment should offer options for manual operation or full automation.
- ✓ **Uniformity and consistency:** Tools should ensure that tea leaves are processed uniformly to maintain consistent quality across batches.
- ✓ **Hygienic design:** Equipment should be easy to clean and maintain to meet food safety standards and prevent contamination.
- ✓ **Control over parameters:** Tools should allow for accurate control of critical parameters such as drying temperature, withering time, or rolling pressure to enhance tea quality.
- ✓ **Energy consumption:** Equipment should be energy efficient to reduce operational costs and environmental impact.

- ✓ **Sustainability:** Consideration should be given to tools and equipment that minimize waste or support recycling of by-products like tea stems or dust.
- ✓ **Material quality:** Equipment made from durable and corrosion-resistant materials (e.g., stainless steel) ensures a longer service life.
- ✓ **Operational reliability:** The tools must function smoothly without frequent breakdowns, which could lead to production delays.
- ✓ **Initial investment:** The upfront cost of purchasing equipment must fit within budgetary constraints.
- ✓ **Maintenance costs:** Select equipment with lower maintenance requirements and easily available spare parts.
- ✓ **Long-term ROI:** Consider the long-term cost-effectiveness, including reduced labor or energy savings, when selecting high-quality equipment.
- ✓ **Modern technology:** Use of advanced technology like computer-controlled drying systems, automated rolling machines, or moisture sensors can enhance productivity and quality.
- ✓ **Upgradability:** Equipment that can be upgraded with new technology or add-ons to meet future processing demands is preferred
- ✓ **Food safety standards:** Ensure that the equipment complies with local and international food safety regulations, such as HACCP, FDA, or ISO standards.
- ✓ **Environmental regulations:** The equipment should comply with environmental standards regarding waste disposal, emissions, and noise levels.
- ✓ **Ease of use:** Equipment should be easy for workers to operate with minimal risk of injury or fatigue.
- ✓ **Safety features:** The tools should be equipped with safety guards, emergency stop buttons, and other features to prevent accidents.
- **Safety precautions for tools and equipment used in tea leaves processing.**
 - ✓ Always handle tools and equipment with care, following manufacturer instructions and guidelines.
 - ✓ Ensure that equipment is well-maintained and in good working condition to prevent accidents.
 - ✓ Wear appropriate PPE, such as gloves, masks, safety glasses, and sturdy footwear, to protect yourself from injuries and exposure to hazards.
 - ✓ Ensure that all moving parts of machinery are guarded to prevent accident
 - ✓ Make sure emergency stop buttons are easily accessible and in good working condition.

- ✓ Conduct regular inspections of machinery to identify and address potential safety hazards.
- ✓ Store sharp tools in a designated area to prevent accidental injuries.
- ✓ Handle sharp tools with care and avoid cutting yourself or others.
- ✓ Protect your hands from burns when handling hot equipment. Avoid touching hot surfaces directly.
- ✓ Always read and follow the instructions on chemical labels.
- ✓ Wear gloves, masks, and eye protection when handling chemicals.
- ✓ Store chemicals in a secure and ventilated area, away from food and beverages.
- ✓ Regularly inspect electrical wiring for damage or fraying.
- ✓ Ensure that electrical equipment is plugged into grounded outlets.
- ✓ Do not plug too many devices into a single circuit.
- ✓ Provide training to employees on safe operating procedures for all equipment.
- ✓ Develop emergency procedures for handling accidents or equipment malfunctions.
- ✓ Conduct regular safety inspections of the workplace to identify and address potential hazard.

•Steps of selecting and adjusting tools and equipment used in tea leaves processing

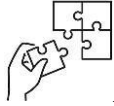
- ✓ Identify the type of tea by determining the type(s) of tea to be processed (e.g., green tea, black tea, oolong, etc.)
- ✓ Measure the available workshop space to ensure the tools and equipment will fit comfortably
- ✓ Analyse the Process flow chart by listing tools and equipment required for each stage
- ✓ Define production capacity by estimating the quantity of tea to be processed daily, weekly, or monthly.
- ✓ Understand the desired quality and compliance with industry or export standards.
- ✓ Arrange for equipment and demonstrate where possible
- ✓ Keep a record of service intervals and any repairs or upgrades.



Points to Remember

- Apply all safety precaution like wearing complete personal protective equipment for preventing accident

- Have a thorough understanding of the tea processing steps, from withering, rolling, fermentation and drying and ensure that the tools and equipment selected are compatible with the specific processing methods you intend to use.
- Adjusting tools and equipment is a common task in tea leaf processing, but it requires careful handling to prevent damage, ensure accuracy, and maintain safety.



Application of learning 1.2

Visit the nearest tea factory which process tea leaves and select tools and equipment to be used in tea leaves processing.



Indicative content 1.3: Selecting materials used in tea leaves processing



Duration: 3 hrs



Theoretical Activity 1.3.1: Identification of materials used during tea leaves processing.



Tasks:

- 1: You are requested to answer the following questions related to identification of materials used in tea leaves processing:
 - i. What could be raw material used to process tea products?
 - ii. What could be cleaning agents that can be used during tea leaves processing?
 - iii. What could be packaging materials that can be used during packaging of tea products?
 - iv. What could be the source of energy used in tea leaves processing?
- 2: Write the answers to questions on papers, flip chart, Blackboard or white board.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the **key readings 1.3.1**



Key readings 1.3.1: Identification of materials used during tea leaves processing.

•Raw Material for Tea Products.

The primary raw material used in processing tea products is **tea leaves**. These leaves are harvested from **tea plants**, specifically **Camellia sinensis** and its varieties.

•Type of cleaning agents used in tea leaves processing

The cleaning agents used in this process must be carefully selected to be effective at cleaning while being safe for use in food processing environments.

The main types of cleaning agents used in tea leaves processing:

- ✓ **Detergents:** are commonly used for general cleaning of equipment, surfaces, and floors in tea processing facilities. Detergents used must be food-grade and safe for cleaning equipment that comes in contact with tea leaves.
- ✓ **Sanitizers:** are used after cleaning to reduce or eliminate microorganisms such as bacteria, molds, and yeasts that could contaminate tea leaves.

- ✓ **Acid Cleaners:** Acid-based cleaners are used for removing mineral deposits (scaling) and stains from equipment. They are particularly useful in tea processing for cleaning drying machines, boilers, and kettles that might develop scale from water used during cleaning or processing.
- ✓ **Enzymatic Cleaners:** are specific enzymes to break down organic material, such as proteins, oils, and fats that might accumulate on equipment used for tea processing. They are particularly useful for cleaning surfaces that come into contact with oily residues from tea leaves.
- ✓ **Disinfectants** are used to kill harmful microorganisms and sanitize surfaces that should come into contact with tea leaves or processing equipment.
- ✓ **Solvent Cleaners:** Solvent-based cleaners are used for cleaning grease, oil, or wax residues from machinery or processing equipment.
- ✓ **Steam Cleaning:** it is not a chemical cleaner; steam cleaning is widely used in tea processing facilities as a natural and effective method for cleaning and sanitizing equipment and surfaces. Steam cleaning eliminates the need for chemical residues and is effective at killing microorganisms and loosening dirt and debris from surfaces.
- ✓ **Water:** Water is the most common cleaning agent used in all stages of cleaning, from rinsing to diluting detergents and sanitizers.

• **Safety precaution of cleaning product**

- ✓ Always read and follow the manufacturer's instructions and safety guidelines on the cleaning product's label
- ✓ Use Personal Protective Equipment (PPE),
- ✓ Always read and follow the manufacturer's instructions and safety guidelines on the cleaning product's label.
- ✓ Always clean in well-ventilated areas to prevent the build-up of fumes that could cause respiratory irritation or poisoning, especially when using chlorine-based or ammonia-based cleaners.
- ✓ Do not use cleaning products in confined or poorly ventilated spaces without proper protective gear and ventilation, as fumes can accumulate and pose health risks.
- ✓ Never mix different cleaning agents, especially those containing ammonia and chlorine, as this can produce toxic gases like chloramine, which can cause serious respiratory problems.
- ✓ Store cleaning products in their original containers, in a cool, dry place, and away from direct sunlight or heat sources. Keep them out of reach of unauthorized personnel or children.
- ✓ Ensure that all containers are clearly labelled with the contents and associated hazards to avoid accidental misuse.

- ✓ Be careful when opening and pouring cleaning agents, and clean up any spills immediately following appropriate spill-handling procedures.
- ✓ Apply cleaning products with proper tools like brushes, mops, or spray bottles to minimize direct contact with chemicals.
- ✓ Ensure that cleaning agents do not come into contact with tea leaves or food-processing areas unless they are specifically labelled as food-safe or intended for that purpose.
- ✓ After using cleaning agents, thoroughly rinse equipment and surfaces with clean water to remove any residues that could affect the quality or safety of tea products,
- ✓ Make sure that first aid measures is available,
- ✓ Follow the manufacturer's recommended clean up procedures, such as using absorbent materials or neutralizing agents.
- ✓ Dispose of unused or expired cleaning products and any contaminated materials according to local environmental regulations. Do not pour hazardous cleaning agents down drains unless they are specifically designed to be diluted and disposed of in that manner.
- ✓ Provides training to employees about safe handling, usage, and first aid measures. Regularly update safety training to keep employees informed about potential risks and new cleaning products.
- ✓ Post safety signs and instructions in areas where cleaning agents are stored or used to remind workers of the necessary precautions
- ✓ Use only the necessary amount of cleaning agent to achieve effective results, reducing potential environmental impact.
- ✓ Where possible, select biodegradable and environmentally friendly cleaning agents that pose fewer risks to both users and the environment,
- ✓ Regularly inspect cleaning equipment (e.g., spray bottles, hoses, etc.) for leaks or defects that could lead to accidental exposure to chemicals.
- ✓ Check cleaning agents for expiration dates and replace any outdated products to ensure their efficacy and safety.

• **Types of packaging material used in tea leaves processing**

✓ **Paper bag**



- ✚ It made from natural fibres, paper is one of the oldest materials used for tea packaging.
- ✚ It is inexpensive, biodegradable, easy to print on, and allows decent water flow during brewing.
- ✚ Paper bags can break or tear easily and may not be suitable for loose leaf teas due to small particles escaping.

✓ **Aluminium Foil**



- ✚ Aluminium foil provides excellent barrier properties against moisture, oxygen, and light.
- ✚ It is lightweight and effective at preserving tea freshness.
- ✚ Aluminium is not biodegradable and can impart a slight metallic taste to some teas.

✓ **Plastic (Nylon)**



- ✚ Nylon is a synthetic material known for its durability and versatility.
- ✚ It does not easily rip or tear and can be heat-sealed without affecting the taste of the tea.
- ✚ Nylon is not biodegradable; concerns exist regarding potential chemical leaching when exposed to boiling water.

✓ **Biodegradable Materials (PLA & Soilon)**



- ✚ Polylactic Acid (PLA) and Soilon are plant-based biodegradable materials gaining popularity in eco-friendly packaging.
- ✚ Both materials are compostable and provide good barriers against moisture and oxygen while being environmentally friendly.
- ✚ They may be more expensive than traditional materials like paper or plastic.

✓ **Filter Paper**



- ✚ A blend of natural fibres that allows water flow during brewing while retaining fine particles.
- ✚ Effective for green teas; compatible with tea bag machines.
- ✚ May lack sturdiness compared to other options.

✓ **Tinplate**



- ✚ A steel sheet coated with tin that offers a non-toxic option for packaging tea.
- ✚ Good barrier properties help protect tea leaves from oxygen and moisture; recyclable.
- ✚ Not as commonly used as other materials for immediate consumer products.

✓ **Cardboard Boxes**



- ✚ It used for outer packaging or holding individually wrapped tea bags.

✚ Eco-friendly since they are recyclable; good for promotional purposes due to printability.

✚ It is less effective at protecting against moisture compared to foil pouches.

• Sources of energy used in tea leaves processing

✓ Electricity

Electricity is increasingly being utilized in **modern tea processing industry** due to its efficiency and ability to provide consistent energy output. Electricity can be sourced from renewable energy options like solar or wind power.

✓ Gas

Natural gas is another common source of energy in tea processing. It is often used for heating purposes during the drying stage. Gas-fired dryers can quickly reach high temperatures necessary for effective moisture removal from the leaves.

✓ Firewood (Eucalyptus)

Firewood, particularly from eucalyptus trees, has traditionally been used as a fuel source in many rural tea processing operations. Eucalyptus wood burns hot and fast, making it suitable for generating heat needed during various processing stages.

✓ Briquette

Briquettes made from compressed biomass materials are an alternative energy source. They are often produced from agricultural residues or waste materials and can provide a cleaner-burning option compared to traditional firewood. Briquettes can be used in place of firewood or coal in drying machines.

✓ Peat

Peat is less commonly used but still serves as an energy source. Peat burns at a lower temperature than wood or gas but can be utilized effectively for heating purposes during the initial stages of tea processing.

Peat extraction has significant environmental impacts due to habitat destruction and carbon release.



Practical Activity 1.3.2: Selecting of materials used during tea leaves processing



Task:

You are requested to go in tea leaves processing workshop to select materials used in tea leaves processing.

- 1: Apply safety precautions.
- 2: Select materials used in tea leaves processing.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 1.3.2 and Ask clarification where necessary
- 5: Perform the task provided in application of learning **1.3**



Key readings 1.3.2: Selecting of materials used during tea leaves processing

- ✓ **Selection criteria for cleaning agents:**
 - ✓ **Food-grade:** must be food-safe and leave no harmful residues on surfaces or equipment.
 - ✓ **Non-reactive:** should not react with materials used in tea processing equipment, such as metals or plastics, to avoid contamination or equipment damage.
 - ✓ **Effectiveness:** must be effective at removing specific types of soil, such as organic residues, oils, or mineral scale, commonly found in tea processing environments.
 - ✓ **Residue-free:** Cleaners must be easy to rinse off, leaving no residues that could affect the flavor or safety of the tea.
 - ✓ **Has not environmental impact:** must be biodegradable and environmentally friendly.
- **Selection criteria of packaging material used in tea leaves processing**
 - ✓ Type of Tea
 - ✓ Protection from Light
 - ✓ Moisture Barrier
 - ✓ Oxygen Barrier
 - ✓ Aroma Preservation
 - ✓ Shelf Life and Durability
- **Selection criteria of tea leaves for processing**
 - ✓ **Leaf Type and Variety**

Choose leaves from specific tea plant varieties (e.g., *Camellia sinensis* var. *sinensis* or *Camellia sinensis* var. *assamica*) based on the type of tea being produced.
Select young, tender shoots (two leaves and a bud) as they typically yield the highest quality tea.
 - ✓ **Freshness**

Ensure the leaves are freshly plucked, ideally processed within a few hours of harvesting

✓ **Plucking Standard**

Fine plucking: Preferably two leaves and a bud, which produce premium-quality tea.

Coarse plucking: Avoid larger, mature leaves and stems unless processing lower-grade tea.

✓ **Color and Appearance**

Look for vibrant green leaves with uniformity in size and shape for green tea processing.

Leaves for black tea processing should be healthy and free from discoloration or blemishes.

✓ **Moisture Content**

Select leaves with optimal moisture levels to ensure effective processing during withering and drying stages.

✓ **Absence of Pests and Diseases**

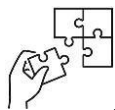
Ensure leaves are free from pest infestations, diseases, or chemical residues.

Inspect for physical damage, such as holes or tears, caused by insects.



Points to Remember

- Ensure the leaves are freshly plucked, ideally processed within a few hours of harvesting
- Careful selection of packaging materials is essential to ensure the integrity of the product and enhance its overall appeal.
- Cleaning agent must be food-safe and leave no harmful residues on surfaces or equipment.



Application of learning 1.3.

Visit the nearest tea factory where they are processing tea leaves and select materials used in tea leaves processing.



Indicative content 1.4: Cleaning of workplace



Duration: 4 hrs



Practical Activity 1.4.1. Cleaning and arranging the workplace



Task:

You are requested to go in food processing workshop to clean and arrange of workplace for tea leaves processing.

- 1: Apply safety precautions.
- 2: Clean and arrange of workplace for tea leaves processing.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 1.4.1 and Ask clarification where necessary
- 5: Perform the task provided in application of learning 1.4



Key readings 1.4.1: Cleaning and arranging of workplace

- **Purpose of cleaning of workplace**
 - ✓ To control hazardous microorganisms;
 - ✓ To control food chemical contamination;
 - ✓ To control foreign body contamination;
 - ✓ To control allergen cross contact;
 - ✓ To control ingredient / residue / color / flavor at product changeover;
 - ✓ To avoid pest infestation;
 - ✓ To control chemical residues from cleaning / sanitation regimes;
 - ✓ To assure mechanical operations of equipment
 - ✓ To improve process efficiency (e.g. heat transfer efficiency);
 - ✓ To assure occupational safety;
 - ✓ To satisfy local regulatory requirements;
 - ✓ To meet specific customer requirements;
- **Application of cleaning methods (wet method and dry method)**
 - ✓ **Dry Cleaning** is a process that uses liquids other than water to clean. Dry cleaning still involves liquids or non-water solvents that are “wet.” It is used for tough stains and time-saving.
 - ✓ **Wet cleaning** is a process of cleaning that uses water as a solvent for cleaning products.

- Application of Cleaning Techniques
 - ✓ **Cleaning in place (CIP)** is a set of activities conducted to properly clean all or part of a process system as it sits in place, without removing or disassembling piping or equipment to accommodate the cleaning.
 - ✓ **Cleaning Out of Place (COP)** is a method of cleaning equipment items by removing them from their operational area and taking them to a designated cleaning station. It requires disassembling of apparatus, and washing it in a central washing area using an automated system.

- **Checking the cleanliness of the workplace**

- ✓ **Visual Inspection (Best Verification Method) Surface appearance:** visible debris, soil build-up, color of equipment surface (white films, stains, etc.), biological growth (i.e., mold) and odor.
- ✓ **ATP testing:** Adenosine Triphosphate is the enzyme that carries chemical energy around living cells. The presence of ATP on a surface indicates that there's life, and in a food processing environment "life" also means potentially dangerous microorganisms.
- ✓ **Riboflavin testing.** Here, before cleaning, the whole surface or at least the difficult to clean part of the surface is sprayed with a riboflavin and dye solution, which becomes fluorescent under UV light. After the cleaning is done, the operator will check with a UV lamp if any areas remained untouched

- **Tea leaves processing line**

- ✓ **Plucking** (Harvesting)

Fresh tea leaves are hand-plucked or mechanically harvested from the tea bushes.

- ✓ **Withering**

The leaves are spread out to reduce moisture content and soften them for the next stage. Withering allows for better rolling and oxidation.

- ✓ **Rolling**

The withered tea leaves are rolled or twisted to break the cell walls and release essential oils. This step influences the flavor of the tea by promoting enzymatic oxidation.

- ✓ **Oxidation/Fermentation** (for black and oolong tea)

During this stage, the leaves are exposed to oxygen to oxidize. The degree of oxidation defines whether the tea is black, oolong, or green.

 **Green Tea:** Skips this step to retain its green color.

 **Black Tea:** Fully oxidized.

 **Oolong Tea:** Partially oxidized.

- ✓ **Drying/Firing**

The leaves are dried to stop the oxidation process and remove remaining moisture. This step helps in preserving the tea for longer shelf life.

✓ **Sorting and Grading**

The dried tea leaves are sorted according to size and grade, using sieves or mechanical sorters.

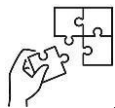
✓ **Packaging**

The finished tea leaves are packaged in various forms (loose-leaf, tea bags, etc.) and prepared for distribution.



Points to Remember

- Proper cleaning and arrangement of tools, equipment, and workplaces are essential to maintain hygiene, prevent contamination, and ensure efficient tea leaf processing.
- Clean all tools, equipment, and surfaces regularly, especially after each use or at the end of each production day and check effectiveness of cleanliness by using visual inspection, ATP Test and Riboflavin test.



Application of learning 1.4.

Visit the nearest tea factory where they are processing tea leaves to clean and arrange tools and equipment used tea leaves processing.



Indicative content 1.5: Receiving green tea leaves



Duration: 4 hrs



Theoretical Activity 1.5.1: Description of quality of tea leaves.



Tasks:

- 1: You are requested to answer the following questions related to description of quality of tea leaves for processing:
 - i. What could be the quality characteristics of tea leaves?
 - ii. What could be factors affecting quality/acceptance of green tea leaves?
- 2: Write the answers to questions on papers, flip chart, Blackboard or white board.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the **key readings 1.5.1**



Key readings 1.5.1: Description of quality of tea leaves

- **Receiving green tea leaves**

This is the initial step where freshly plucked tea leaves are delivered to the processing facility from the tea gardens. The leaves are inspected for quality and condition upon arrival.

- ✓ **Purposes of receiving green tea leaves**

-  To ensure that only high-quality leaves are accepted for processing.
-  To prevent poor-quality leaves from entering the production process and affecting the final product's quality.
-  To maintaining the freshness and quality of the green tea leaves is critical at this stage to produce high-grade tea.

- **Weighing of green tea leaves**

Weighing of Tea Leaves is measuring the total weight of the green tea leaves received from the tea gardens.

- ✓ **Purpose of weighing tea leaves**

-  To track the quantity of tea leaves delivered,
-  To monitor yield.
-  Weighting is essential for inventory management and evaluating productivity,
-  Helping with efficient scheduling and processing time.

- ✓ **Sampling of green tea leaves**

Sampling of Green Tea Leaves is the process of selecting a small, representative portion of the tea leaves to evaluate the overall quality of the batch.

✓ **Purpose of sampling tea leaves**

- ✚ To assess the quality, uniformity, and suitability of the leaves for processing,
- ✚ Sampling ensures that only leaves meeting the required standards proceed to further stages,
- ✚ Helps to detect any defects or inconsistencies in the tea leaves, such as pest damage or improper plucking, before they enter production.

✓ **Sampling Techniques for Tea Leaves**

- ✚ **Random Sampling:** Picking leaves randomly from various parts of the batch to ensure that the sample represents the entire delivery.
- ✚ **Stratified Sampling:** Dividing the batch into different sections or layers and sampling from each section proportionally.
- ✚ **Systematic Sampling:** Selecting every nth leaf from a batch, ensuring uniform sampling across the entire batch

✓ **Factors affecting quality/Acceptance of green tea leaves**

- ✚ **Harvesting Period:** The season when the tea leaves are plucked. Tea leaves harvested during certain periods (like spring) tend to be of higher quality.
- ✚ **Time of Delivery:** Leaves should be delivered to the processing facility soon after plucking to retain freshness. Delays can result in withering or deterioration.
- ✚ **Harvesting Techniques:** Hand-plucking generally produces higher-quality leaves than machine harvesting, which may damage leaves or include too many coarse leaves.
- ✚ **Season:** Seasonal factors (rainy vs. dry season) influence leaf quality. For example, spring and early summer tea leaves are often of higher quality than those harvested during the monsoon.



Practical Activity 1.5.2. Receiving green tea leaves



Task:

You are requested to go in food processing workshop to receive tea leaves for processing.

- 1: Apply safety precautions.
- 2: Receive tea leaves for tea leaves processing.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 1.5.2 and Ask clarification where necessary

5: Perform the task provided in application of learning 1.5



Key readings 1.5.2: Receiving green tea leaves

•Tea leaf count

Leaf count refers to the process of counting the number of leaves per shoot, typically focusing on the number of tender leaves and buds for preparation of plucking in order to produce better-quality tea leaves.

Two leaves and bud is preferred while plucking (harvesting) tea.

✓ **Plucking (harvesting) standard of tea leaves**

It refers to the guidelines set for selecting tea leaves during harvesting. These standards usually focus on the number of young leaves and buds plucked.

Standards are:

✚ **Fine Plucking:** Two leaves and a bud (the highest quality).

✚ **Medium Plucking:** Three to four leaves and a bud (moderate quality).

✚ **Coarse Plucking:** More than four leaves (lower quality)

✓ **Interpretation of tea leaf count results**

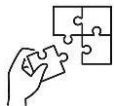
✚ **High Bud Count:** Indicates that the tea leaves are of high quality, suitable for producing premium tea.

✚ **Low Bud Count:** Suggests a lower-quality batch, possibly due to poor plucking standards or over grown leaves.



Points to Remember

- Leaf count refers to the process of counting the number of leaves per shoot and two leaves and bud is preferred while plucking (harvesting) tea.
- Select samples randomly to avoid bias and ensure a representative representation of the entire batch.
- Maintain a consistent temperature and humidity level during leaf counting to prevent changes in leaf size or weight.



Application of learning 1.5.

You are requested to go in tea leaves processing workshop and receive green tea leaves.



Indicative content 1.6: Steaming of tea leaves for green tea making



Duration: 2 hrs



Practical Activity 1.6.1. Steaming tea leaves for green tea making



Task:

You are requested to go in tea leaves processing workshop to steam tea leaves for green tea making.

- 1: Apply safety precautions.
- 2: Receive tea leaves for tea leaves processing.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 1.6.1 and Ask clarification where necessary
- 5: Perform the task provided in application of learning 1.6



Key readings 1.6.1: Steaming tea leaves for green tea making

- **Steaming of tea leaves for green tea making**

Steaming is a process where freshly plucked green tea leaves are exposed to steam to halt oxidation.

- ✓ **Purpose of steaming green tea leaves:**

- ✚ To stop the enzymatic oxidation process,
- ✚ To preserve the green color and fresh flavor of the leaves.
- ✚ Locks in nutrients such as antioxidants and vitamins present in green tea leaves

- ✓ **Cooling of steamed green tea leaves**

It is the process of rapidly lowering the temperature of tea leaves after steaming.

- ✓ **Purposes of cooling steamed green tea leaves**

- ✚ To stop the cooking process and stabilize the leaves for next processing steps such as rolling and drying.
- ✚ To stops the steaming process, preventing the leaves from becoming overcooked, which would negatively affect flavor and texture.
- ✚ To ensures the leaves retain their color, aroma, and nutrients, by preserving their quality,

- ✚ Helps to Prepares for Next Steps for bringing the leaves to an ideal temperature for rolling, ensuring they are pliable but not too soft.

✓ **Cooling conditions of green tea leaves**

- ✚ **Temperature:** The cooling process usually reduces the leaves' temperature to around 25-30°C to ensure they are ready for rolling
- ✚ **Air Circulation:** Proper ventilation is necessary to cool the leaves uniformly. Controlled airflow ensures rapid and even cooling.
- ✚ **Time:** Cooling should be done quickly to prevent oxidation or degradation of the leaves. Typically, this process takes a few minutes to an hour, depending on the volume of leaves.

- **Steam generation**

Steam generation is the process of converting liquid water into water vapor, or steam. This transformation occurs when water is heated to its boiling point, which is 100°C at standard atmospheric pressure.

✓ **Steps of steam generation during tea leaves steaming**

✚ **Heating:**

Water is heated to its boiling point (100°C or 212°F) in a suitable container or steamer. The heat can be provided by various methods, including electric heating, gas heating, or direct flame.

✚ **Vaporization:**

As the water reaches its boiling point, the molecules gain enough energy to overcome the intermolecular forces holding them together in the liquid state.

This causes the water to vaporize, transforming into a gas.

As the water reaches its boiling point, it begins to vaporize, transforming from a liquid to a gaseous state.

✚ **Steam formation:** The vaporized water forms steam, which is a highly energetic and humid gas.

Steam Distribution: The steamer is designed to efficiently distribute the generated steam to the tea leaves. The steam is directed to come into direct contact with the tea leaves, ensuring even heating and moisture absorption.

Heat Transfer: The steam transfers heat to the tea leaves through both conduction (direct contact) and convection (movement of the steam).

The tea leaves gradually increase in temperature, reaching the desired range for steaming (typically 180-200°F or 82-93°C).

Moisture Absorption: The steam creates a humid environment around the tea leaves, allowing them to absorb moisture. This hydration is essential for softening the leaves, facilitating the subsequent rolling and drying processes.

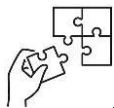
- **Factors Affecting Steam Generation:**

- ✓ **Water quality:** The quality of the water used can influence steam generation. Impurities in the water may affect the boiling point and the properties of the steam.
- ✓ **Steamer design:** The efficiency and effectiveness of steam generation depend on the design and construction of the steamer.
- ✓ **Temperature control:** Precise temperature control is essential to ensure optimal steaming conditions and prevent over-processing.



Points to Remember

- Avoid over steaming because excessive heat can cause the tea leaves to brown and lose their fresh, green colour.
- Pressure vessels, such as boilers and steam generators, should be regularly inspected and maintained to ensure they are in safe operating condition and wear appropriate personal protective equipment, including gloves, eye protection, and heat-resistant clothing, to prevent burns or injuries.
- If the temperature is too low below 82-93°C, the enzymes in the tea leaves may not be fully inactivated. This can lead to continued oxidation, resulting in a darker colour, a more bitter taste, and a loss of fresh flavour.
- If the temperature is too high above 82-93°C, the tea leaves may become over-oxidized. This can cause the leaves to brown, develop a bitter taste, and lose their delicate aroma and avoid excessive steaming, as it can lead to browning, bitterness, and nutrient loss.



Application of learning 1.6.

You are requested to go in tea leaves processing workshop and steam tea leaves for green tea making.



Indicative content 1.7: Monitoring withering conditions of green tea leaves



Duration: 2 hrs



Theoretical Activity 1.7.1: Description of withering process



Tasks:

- 1: You are requested to answer the following questions related to description of steaming process of tea leave during processing:
 - i. What do you understand by withering process of tea leaves?
 - ii. What could be purpose of withering green tea leaves?
 - iii. What could be different between physical withering and chemical withering of green tea leaves?
 - iv. What are withering conditions for tea leaves?
 - v. What could be chemical and physical change during withering?
- 2: Write the answers to questions on papers, flip chart, Blackboard or white board.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the **key readings 1.7.1**



Key readings 1.7.1: Description of withering process

• Withering in Tea Leaves Processing

Withering is the process of reducing moisture content in freshly plucked tea leaves to make them soft and pliable, preparing them for further processing such as rolling and oxidation.

It also initiates chemical changes that influence the final flavor of the tea.

✓ **Monitoring Withering Conditions**

It involves checking **moisture loss**, **texture changes**, and the **aroma development** in the leaves to ensure proper softening without over-drying or under processing.

The tools used during monitoring withering conditions are:

-  Temperature gauges
-  Hydrometer
-  airflow controllers

✓ **Purpose of Withering Green Tea Leaves**

-  Reduces the moisture content of the tea leaves, making them flexible for rolling.
-  Chemical Changes for developing the flavor, aroma, and character of the tea.

✚ Softens the leaves to prevent breakage during the rolling process.

✓ **Types of Withering**

✚ **Chemical Withering:**

It is the breakdown of leaf compounds like proteins and starches through enzymatic activity, leading to the development of the tea's flavor and aroma.

It is break down cellular components, producing chemical reactions that contribute to the aroma and flavor profile of the final tea product.

✚ **Physical Withering:**

It is the process of removing moisture from tea leaves through environmental control, such as regulating temperature, humidity, and airflow, without directly influencing the chemical composition.

It is process reducing moisture from the leaves through controlled environmental conditions like airflow, temperature, and humidity.

✓ **Description of withering conditions**

✚ **Relative Humidity** of the Withering Room must be around **65-75%**.

Lower humidity can cause the leaves to dry too quickly

Higher humidity may result in inadequate moisture removal.

✚ **Temperature of Green/Tea Leaves** carried out at room temperatures **between 20-25°C**.

If the temperature is too high, the leaves may lose moisture too rapidly, affecting quality.

✚ **Airflow** Adequate airflow is crucial to evenly remove moisture from the leaves. The air must circulate well enough to dry the leaves uniformly without causing them to dry out too quickly.

✚ **Duration of withering process:** The duration of withering can vary but typically ranges from 8- 18 hours.

The time depends on the following factors:

✚ Leaf type

✚ Weather conditions

✚ Tea variety being processed.

✓ **Chemical and physical changes during withering**

✚ **Chemical Changes:** Proteins break down into amino acids, and carbohydrates convert into simpler sugars, contributing to flavor development. Polyphenol oxidase activity begins, initiating flavor and aroma changes.

✚ **Physical Changes:** Leaves lose 25-30% of their initial moisture content, becoming softer and more flexible, making them suitable for rolling and oxidation.

✓ **Parameters affected by withering process**

✚ **Color:** Withering causes a change in leaf color from bright green to a more dull green or yellow, indicating moisture loss and initial chemical changes.

- ✚ **Moisture Content:** Proper withering should reduce moisture to around 60-70% for optimal rolling and oxidation
- ✚ **Smell:** A fruity or floral smell develops as the leaves undergo chemical withering, indicating enzymatic activity and flavor development



Practical Activity 1.7.2. Withering green tea leaves



Task:

You are requested to go in food processing workshop to wither green tea leaves.

- 1: Apply safety precautions.
- 2: Wither green tea leaves.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 1.7.2 and Ask clarification where necessary
- 5: Perform the task provided in application of learning **1.7**



Key readings 1.7.2: Withering green tea leaves

- **Description of hard wither and soft wither**
 - ✓ **Characteristics of hard wither and soft wither (moisture content)**
 - ✚ **Hard wither:** Leaves lose too much moisture, becoming dry and brittle. The moisture content falls below 55%, leading to over-dried leaves.
 - ✚ **Soft wither:** Leaves retain more moisture (above 65%), making them too soft and less pliable for rolling.
 - ✓ **Causes of hard wither and soft wither**
 - ✚ **Hard Wither:** Caused by excessive air circulation, high temperatures, or low humidity, leading to too rapid moisture loss.
 - ✚ **Soft Wither:** Caused by insufficient airflow, high humidity, or short withering time, leading to incomplete moisture removal.
 - ✓ **Effects of hard and soft wither on tea product quality**
 - ✚ **Hard Wither:** Produces dry, lifeless tea with poor flavor development. The leaves may be difficult to roll and can result in breakage.
 - ✚ **Soft Wither:** Produces tea with a flat, underdeveloped flavor and poor aroma. The leaves may be too limp for effective rolling, affecting shape and texture.
- **Procedures of withering tea leaves**
 - ✓ **Leaf Reception and Inspection**

- ✚ Inspect fresh leaves: Ensure the leaves are fresh, tender, and free from pests, diseases, or foreign materials.
- ✚ Weigh the leaves: Record the weight of the fresh leaves for tracking moisture loss during withering.

✓ **Spread the Leaves**

Spread the tea leaves evenly on withering troughs or trays. The layer should not exceed 8–10 cm in thickness to allow proper air circulation.

✓ **Air Circulation**

- ✚ Natural withering: Place leaves in a well-ventilated room with controlled airflow. Use fans or open windows to allow natural air circulation.
- ✚ Mechanical withering: Use withering machines with controlled airflow and temperature settings for efficiency.

✓ **Monitor Temperature and Humidity**

- ✚ Maintain an ambient temperature of 20–30°C (68–86°F).
- ✚ Ensure relative humidity is between 60–70% to prevent overdrying or excessive wilting and avoid direct sunlight or excessively high temperatures, which can damage the leaves and degrade quality.

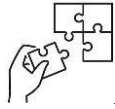
✓ **Control the Duration**

- ✚ Withering time for green tea is typically 4–6 hours, depending on environmental conditions and the moisture content of the leaves.
- ✚ Adjust the duration to achieve partial water loss (approximately 25–30% moisture reduction).



Points to Remember

- Use only approved chemicals specifically designed for tea processing. Avoid harmful or illegal substances.
- Adhere to recommended concentrations to prevent excessive chemical residue on the tea leaves
- Maintain a temperature between 20-25°C because higher temperatures can accelerate the withering process, but excessive heat can damage the leaves and lead to a loss of aroma and flavour.
- Keep the humidity levels relatively low to prevent mold and mildew growth. High humidity can also cause the leaves to become sticky and clump together.
- Avoid excessive manipulation of the leaves, as this can bruise them and affect their quality.



Application of learning 1.7.

You are request to go in tea leaves processing workshop and wither green tea leaves.



Learning outcome 1 end assessment

Theoretical assessment

1. Read careful the following statements related to tea leaves processing and choose by encircling the letter corresponding to the correct answer.

- i. What is the primary purpose of tea leaves processing?
 - a) To package tea leaves
 - b) To preserve and enhance the flavor of tea leaves
 - c) To grow tea leaves faster
 - d) To sell tea in the market
- ii. Which type of tea undergoes full oxidation during processing?
 - a) Green Tea
 - b) Oolong Tea
 - c) Black Tea
 - d) White Tea
- iii. Which of the following equipment is used in the withering process of tea?
 - a) Rolling machine
 - b) Withering trough
 - c) Dryer
 - d) Fermentation chamber
- iv. What is the primary tool used to roll tea leaves?
 - a) Sieve
 - b) Heater
 - c) Rolling machine
 - d) Shaker
- v. What type of tea leaves are commonly used for processing green tea?
 - a) Withered tea leaves
 - b) Fresh green tea leaves
 - c) Fermented tea leaves
 - d) Rolled tea leaves
- vi. Which of the following is NOT a material used in tea leaves processing?
 - a) Fresh tea leaves
 - b) Stems and twigs

- c) Heat-treated water
 - d) Fermentation enzymes
- vii. What is the first step after receiving green tea leaves for processing?
- a) Rolling the tea leaves
 - b) Cleaning the leaves
 - c) Inspecting for quality and freshness
 - d) Storing the tea leaves
- viii. Which of the following is NOT part of the inspection when receiving green tea leaves?
- a) Checking leaf freshness
 - b) Measuring leaf size
 - c) Assessing the color of leaves
 - d) Shredding leaves for processing
- ix. What is the purpose of withering green tea leaves?
- a) To start oxidation
 - b) To reduce moisture content
 - c) To dry the tea leaves completely
 - d) To roll the tea leaves
- x. Withering of green tea leaves primarily reduces:
- a) Flavor
 - b) Oxidation
 - c) Moisture content
 - d) Leaf color
- xi. What is the primary purpose of steaming green tea leaves?
- a) To remove moisture
 - b) To stop oxidation
 - c) To add flavor
 - d) To ferment the tea leaves
- xii. Which of the following processes follows steaming in green tea production?
- a) Rolling
 - b) Withering
 - c) Drying
 - d) Fermentation

2. Read carefully the following statement bellow related to tea leaves processing and answer by True if the statement is correct or False if is not correct.

1. Tea leaves processing involves a single step to ensure flavour development.
2. Withering is an essential step for both green tea and black tea processing.
3. A rolling machine is used to prevent oxidation in green tea processing.
4. Cleaning the workplace is essential for ensuring the safety and hygiene of tea leaves during processing.
5. Cleaning is only done before processing begins, not during or after.
6. Steaming tea leaves helps to preserve the fresh green colour and prevent oxidation.
7. Steaming is a process used in green tea production.

3. Read carefully the table below and answer the question by matching the description in column B and their terms in column C and write letter in space provided in column (A) corresponding to the correct answer.

Column A(Answer)	Column C(Description)	Column B(Terms)
1)	1. Keeps the tea leaves fresh and prevents browning.	A. Withering
2)	2. The process of reducing moisture from fresh tea leaves.	B. Fermentation
3)	3. Shaping and breaking down tea leaves after withering.	C. Steaming
4)	4. process of converting liquid water into water vapor	D. squeezing
5)	5. Quick application of steam to halt enzymatic activity.	E. Prevents Oxidation
		F. Rolling
		G. Steam generation

4. Read careful the following statements related to tea leaves processing and fill in the gaps by choosing in the following words in blanket: (moisture, green tea leaves, oxidation, clean, quality, contamination, cooled, reduction, withering, steaming)

- 1) The primary material used in tea leaves processing is
- 2) Tea processing requires clean, uncontaminated materials to avoid affecting the.....of the final tea product.
- 3) Proper cleaning of the workplace prevents.....of tea leaves.

- 4) Tools and equipment must be cleaned withwater before tea leaves processing begins.
- 5) Steaming tea leaves is done to stop..... in green tea production.
- 6) After steaming, tea leaves are.....to prepare for the rolling process.
- 7) Withering helps to reduce thecontent of the tea leaves to make them more pliable for rolling.

Practical assessment

AB Tea cooperative is a company that produces black tea and green tea. It wishes to hire a technician who is skilled in workplace and tea leaves preparation which will be used for producing black tea and green tea. The manager of the company asks you to prepare workplace and tea leaves which will be used for producing black tea and green.



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Learning Outcome 2: Ferment Rolled Tea Leaves



Indicative contents

2.1 Sifting withered tea leaves

2.2 Rolling withered and green tea leaves

2.3 Fermenting tea leaves

Key Competencies for Learning Outcome 2: Ferment Rolled Tea Leaves

Knowledge	Skills	Attitudes
● Description of sifting techniques ● Description of the method of fermentation ● Description of factors influencing the fermentation process ● Differentiation of chemical and physical changes during fermentation	● Sifting withered tea leaves ● Rolling withered and green tea leaves ● Fermenting tea leaves	● Being carefully during sifting ● Being attentive during rolling withering and green tea leaves ● Being attentive during fermentation of tea leaves



Duration: 15 hrs

Learning outcome 2 objectives:



By the end of the learning outcome, the trainees will be able to:

1. Describe properly sifting techniques of tea leaves in tea leaves processing
2. Sift correctly withered and steamed tea leaves in tea leaves processing
3. Roll effectively withered and green tea leaves in tea leaves processing
4. Differentiate correctly chemical and physical changes used during fermentation of method of fermentation
5. Describe correctly the method of fermentation in tea leaves processing
6. Describe properly the factors influencing fermentation process in tea leaves processing
7. Ferment properly withered tea leaves in tea leaves processing



Resources

Equipment	Tools	Materials
● Fan, ● Sifter ● Magnet ● Weigh feeder ● Conveyors ● Rotor van ● CTC roller ● Fermentation unit ● High pressure washer ● Trolley ● PPE ● Circular saw ● Rolling table ● Rotary drum	● Thermometer ● Hygrometer ● Basket ● Brooms ● Spade	● Green/tea leaves ● Cleaning agents ● Water



Indicative content 2.1: Sifting withered tea leaves



Duration: 5 hrs



Practical Activity 2.1.1: Sifting withered tea leaves



Task:

You are requested to go in food processing workshop to sift withered tea leaves.

- 1: Apply safety precautions.
- 2: Sift withered tea leaves.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 2.1.1 and Ask clarification where necessary
- 5: Perform the task provided in application of learning 2.1.



Key readings 2.1.1: Sifting withered tea leaves

• **Sifting** refers to the process of passing the tea leaves through a mesh or sieve to separate them based on size, quality, and type. This step is done after withering and before further processing to ensure uniformity and remove any unwanted particles, such as stems or large leaf fragments.

• **Purposes of Sifting the Withered Tea Leaves**

- ✓ Ensures that the tea leaves are of uniform size, which helps in consistent rolling, oxidation, and drying.
- ✓ Removes (impurities) unwanted large stems, fibers, or debris from the batch.
- ✓ Helps in separating tea leaves into different grades or sizes for specific processing or marketing purposes.

• **Sifting Techniques**

✓ **Mechanical Sifting:**

Uses machines with rotating or vibrating screens to sift the leaves. These machines are equipped with sieves of varying sizes that separate the tea leaves into different categories.

Mechanical sifting is commonly used in large-scale tea production for efficiency and accuracy.

Advantages: Fast, consistent, and able to handle large volumes of leaves.

✓ **Manual Sifting.**

This use of hand-held sieves or baskets to sift small batches of tea leaves. Workers manually shake the sieve, allowing smaller leaves to pass through while larger leaves or debris remain on the sieve.

Advantages: Better control over the sifting process in small-scale or artisanal tea production. Suitable for premium or specialty teas.

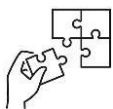
• **Keys steps of sifting withered tea leaves**

- ✓ Preparation of sifter
- ✓ Gather the Withered Tea Leaves
- ✓ Place Tea Leaves on the Sifter
- ✓ Shake or Agitate the Sifter
- ✓ Collect Fine Particles
- ✓ Sort and Inspect the Larger Leaves
- ✓ Final Collection



Points to Remember

- After the withering process, gently collect the withered tea leaves to avoid breaking or damaging them
- Choose the correct mesh size based on the type of tea and the desired leaf size. Larger mesh for whole leaves, finer mesh for broken or finer grades.
- Ensure that the withered tea leaves are not too moist or too dry. Too much moisture can cause leaves to clump, making sifting difficult, while overly dry leaves may crumble easily.



Application of learning 2.1.

Visit the nearest tea factory where they are processing tea leaves and sift withered tea leaves.



Indicative content 2.2: Rolling withered and green tea leaves



Duration: 5 hrs



Practical Activity 2.2.1: Rolling withered and green tea leaves



Task:

You are requested to go in tea leaves processing workshop to roll withered tea leaves.

- 1: Apply safety precautions.
- 2: Roll withered tea leaves.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 2.2.1 and ask clarification where necessary
- 5: Perform the task provided in application of learning 2.2.



Key readings 2.2.1: Rolling withered and green tea leaves

• **Rolling withered tea leaves** the process of physically shaping the tea leaves by bending or crushing them after they have been withered. This breaks down the cell walls, **releasing the natural juices and enzymes**, which contribute to oxidation in black teas or form the distinctive shapes in green teas.

• Purposes of Rolling/Maceration

- ✓ For black and oolong teas, rolling helps release enzymes and essential oils, starting the oxidation process.
- ✓ Helps in shape formation of tea leaves into the desired forms, such as twists (bends) or curls, enhancing the tea's appearance.
- ✓ Contributes in flavor development to the release of essential oils, which enhances the flavor and aroma profile of the tea.
- ✓ Green tea leaves are not oxidized, so the rolling process is primarily to shape the leaves and aid in drying rather than initiating oxidation.
- ✓ While green tea is not oxidized, rolling still releases some natural oils and flavors that improve the tea's taste when brewed.

• Monitoring Parameters Affecting Rolling of Tea Leaves

- ✓ **Temperature:**

Higher temperatures during rolling can accelerate oxidation but can also overheat and damage the leaves. It needs to be carefully controlled to avoid affecting the quality.

✓ **Rate of Feeding:**

The speed at which tea leaves are fed into rolling machines affects the degree of maceration. Too fast, and the leaves may not be properly rolled; too slow, and oxidation could be uneven.

✓ **Meshing and Tightening (CTC, Rotor Vane):**

CTC (Crush, Tear, Curl) machines and rotor vanes apply varying degrees of pressure. Tighter settings lead to finer rolling or cutting, impacting the tea's texture and strength.

✓ **Cooling of Cutting Rollers:**

Overheating of cutting rollers can damage the tea leaves during rolling, so cooling mechanisms are used to maintain optimal processing temperatures.

✓ **Degree of Withering (Hard Withers and Soft Withers):**

Hard withers (greater moisture loss) may lead to drier leaves that break easily during rolling, while soft withers (less moisture loss) may result in leaves that are too wet and not roll effectively.

• **Process of rolling withered tea leaves**

✓ **Preparation of Withered Leaves:** Collect leaves after the withering process when they are soft and pliable.

✓ **Mechanical or Manual Rolling:** Place the withered leaves in a mechanical roller or hand-roll them. This process applies pressure to rupture cell walls, releasing juices and essential oils.

✓ **Initiation of Oxidation:** The cell rupture allows enzymes to interact with oxygen, initiating the oxidation process crucial for black and oolong teas.

✓ **Shaping the Leaves:** Rolling shapes the leaves into desired forms (twisted, curled, or balled). Different shapes influence flavor release and presentation.

✓ **Resting (Oolong Teas):** For oolong tea, the leaves may rest between rolling sessions to allow even oxidation.

✓ **Quality Control:** Monitor the leaves to ensure they are not over-rolled, which can damage them and create bitterness.

• **Process of rolling withered tea leaves**

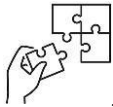
✓ **Initial Heat Treatment (Optional):** Lightly steam or pan-fire the fresh tea leaves to prevent oxidation and preserve their green color and fresh flavor.

- ✓ **Gentle Rolling:** Roll the leaves lightly to shape them without damaging their structure. The goal is to curl, twist, or flatten the leaves, depending on the tea type.
- ✓ **Multiple Rolling Rounds:** Perform several rounds of rolling, with breaks in between, to gradually shape the leaves into their final form. Each round refines the shape and texture.
- ✓ **Check for Uniformity:** Ensure the leaves have a consistent shape and size, which will affect how evenly they release flavor during brewing.
- ✓ **Final Drying:** After rolling, the leaves are typically dried further to lock in their shape and preserve their freshness for storage and consumption.



Points to Remember

- Rolling green tea aims to preserve the tea's fresh, vegetal qualities rather than induce oxidation and hand-rolling is often used for premium green teas, ensuring a more uniform and aesthetically pleasing shape.
- Rolling duration and intensity impact the oxidation level, influencing the flavor profile (light, medium, or heavily oxidized) and over-rolling can damage the leaves, leading to an overly bitter flavor due to excessive cell rupture



Application of learning 2.2.

Visit the nearest tea factory where they are processing tea leaves and roll withered and green tea leaves.



Indicative content 2.3: Fermenting tea leaves



Duration: 5 hrs



Theoretical Activity 2.3.1: Description of fermentation methods of rolled tea leaves

Tasks:

- 1: You are requested to answer the following questions related to description of fermentation process of rolled tea leaves:
 - i: What do you understand by fermentation process of tea leaves?
 - ii: What could be purpose of fermentation process tea leaves?
 - iii: What could be different between convention fermentation and modern fermentation?
 - iv: What could be chemical and physical change during fermentation of rolled tea leaves
- 2: Provide the answers to asked questions by writing them on papers, flip chart, Blackboard or white board.
- 3: Present the findings/answers to the whole class.
- 4: For more clarification, read the **key readings 2.3.1** and ask questions where necessary



Key readings 2.3.1: Description of fermentation process of rolled tea leaves (dhool)

- **Fermentation process of rolled tea leaves**

Fermentation process of rolled tea leaves refers to the enzymatic oxidation of polyphenols in tea leaves, which occurs after rolling. It primarily applies to black and oolong teas, where the leaves are allowed to oxidize before being dried. Fermentation changes the color, flavor, and aroma of the tea.

Dhool refers to the crushed and torn tea leaves that are created during the fermentation process. The dhool has a coppery color.

- ✓ **Purposes of Fermentation Process**

- ✚ Contributes Flavor development to the rich, malty, or fruity flavors found in black and oolong teas.
- ✚ The oxidation process carried in fermentation contribute to the color change (darkens the tea leaves), giving black tea its characteristic color.
- ✚ Brings out complex aromas, often fruity, floral, or earthy, depending on the tea variety.

✓ **Methods of Fermentation**

 Conventional Fermentation:

It Involves spreading the tea leaves on trays in a cool, humid environment to allow natural oxidation. Time and environmental conditions are controlled to ensure even fermentation.

 Modern Fermentation:

Uses controlled chambers where temperature, humidity, and airflow are precisely regulated. This method allows for more consistent and efficient fermentation.

✓ **Chemical and Physical Changes During Fermentation**

 Chemical changes:

Polyphenols (like catechins) oxidize into theaflavins and thearubigins, which contribute to the tea's color and taste. Enzymes break down proteins and carbohydrates, influencing flavor.

 Physical Changes:

Leaves change from green to reddish-brown or dark brown as oxidation progresses.

They also become more pliable and softer due to enzymatic breakdown.



Practical Activity 2.3.2: Fermenting tea leaves



Task:

Referring to the previous theoretical activity 2.3.1, you are requested to go in tea leaves processing workshop to ferment tea leaves.

- 1: Apply safety precautions.
- 2: Ferment tea leaves.
- 3: Present your work to the trainer and whole class.
- 4: Read key reading 2.3.2. and ask clarification where necessary
- 5: Perform the task provided in application of learning 2.3.



Key readings 2.3.2: Fermenting tea leaves

✓ **Factors Influencing Fermentation Process**

✓ **Time of Fermentation:**

The duration of fermentation influences the flavor and color of the tea. Longer fermentation can result in darker, stronger tea, while shorter fermentation preserves more delicate flavors.

✓ **Temperature of the Tea:**

The temperature of the fermenting leaves (called dhool) must be controlled. Too high a temperature can speed up oxidation too quickly, while too low a temperature may slow it down excessively.

✓ **Relative Humidity of Fermentation Room:**

High humidity promotes consistent oxidation, while low humidity may result in uneven fermentation.

✓ **Oxygen Availability (Volume of Air):**

Adequate air circulation is essential for proper oxidation, as oxygen fuels the enzymatic reactions in the leaves.

✓ **Thickness of Spreading:**

The thickness of the tea leaves during fermentation affects how evenly they oxidize. If spread too thickly, the inner leaves may not receive enough air, leading to uneven fermentation.

• **Monitoring Fermentation Process**

✓ **Visual Observation:** The color of the leaves are monitored for the desired level of fermentation.

✓ **Smell:** The aroma of the fermenting leaves gives clues about their progression.

✓ **Temperature Control:** Keeping the fermentation room at the correct temperature is vital to achieving consistent results.

✓ **Time Tracking:** Precise control of fermentation time is necessary to avoid under- or over fermentation.

• **Fermentation process of rolled tea leaves**

✓ **Preparation after Rolling**

After rolling, the tea leaves are spread out in thin layers on trays or a flat surface to expose them to air. The rolling has broken down the cell walls, allowing the oxidation process to begin.

✓ **Control of Environmental Conditions**

✚ **Humidity:** The room is kept at a controlled high humidity level (around 90-95%) to encourage the oxidation process. This moisture helps the tea leaves oxidize evenly.

 **Temperature:** The ideal temperature for fermentation is typically between 24°C and 30°C (75°F to 86°F). Higher temperatures speed up the process, but too much heat can cause over-fermentation, leading to a bitter taste.

✓ **Monitoring Color and Aroma**

 As oxidation progresses, the green leaves will gradually turn a reddish-brown color.

 Tea producers closely monitor the changing color and aroma of the leaves to ensure the fermentation is proceeding as desired.

 The leaves also begin to emit a characteristic floral or fruity scent as oxidation develops.

✓ **Duration of Fermentation**

The duration of fermentation depends on the type of tea being produced:

 **Black Tea:** Typically fermented for 1 to 4 hours or until the leaves reach a fully oxidized state, turning completely dark.

 **Oolong Tea:** Fermentation is stopped at a partially oxidized stage (10% to 80% oxidation), resulting in a range of oolong varieties from lightly oxidized to heavily oxidized.

✓ **Stopping the Fermentation Process**

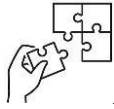
Once the desired level of oxidation is reached, the fermentation must be stopped immediately. This is done by applying heat through:

 **Firing (Pan-firing or Baking):** The leaves are exposed to high heat to halt the enzymatic oxidation and preserve the flavor profile. This also helps to reduce the moisture content in the leaves and prepare them for storage.



Points to Remember

- Maintain the ideal temperature, typically between 24°C and 30°C (75°F to 86°F), depending on the type of tea. Higher temperatures speed up oxidation but can lead to over-fermentation and bitter flavors, while lower temperatures may slow the process down too much.
- Keep the humidity level around 90-95% to allow the leaves to oxidize uniformly. Low humidity can cause uneven fermentation, while excessive humidity might promote mold or spoilage.
- Timing is critical. Black tea typically requires 1-4 hours of fermentation, while oolong tea requires less time depending on the desired oxidation level.



Application of learning 2.3.

Visit the nearest tea factory where they are processing tea leaves and ferment tea leaves.



Learning Outcome 2 end assessment

Theoretical assessment

1. Read carefully the following statements, choose and write the letter corresponding to the right answer.

- i. What is the main purpose of fermentation in tea processing?
 - a) To dry the tea leaves
 - b) To oxidize the leaves and develop flavor
 - c) To clean the leaves
 - d) To make the leaves soft
- ii. Which type of tea undergoes a rolling process primarily to shape the leaves without inducing oxidation?
 - a) Black tea
 - b) Green tea
 - c) Oolong tea
 - d) White tea
- iii. What happens to the color of tea leaves during fermentation?
 - a) They turn green
 - b) They remain unchanged
 - c) They turn reddish-brown
 - d) They turn white
- iv. How is the fermentation process stopped?
 - a) By applying heat
 - b) By adding water
 - c) By freezing the leaves
 - d) By exposing the leaves to sunlight
- v. What is the main purpose of rolling withered tea leaves?
 - a) To dry the leaves completely
 - b) To initiate the oxidation process
 - c) To retain moisture in the leaves
 - d) To stop fermentation

2. In the table below, match the following terms related to the fermentation process of tea leaves in **Column B** with their corresponding description in **Column C** by writing the letter corresponding to the right answer in the provided space in **Column A**.

Column A	Column B	Column C
1.....	A. Oxidation	1. No oxidation, shaping only
2.....	B. Temperature	2. The gas needed for fermentation
3.....	C. Yellow tea	3. The process where tea leaves change color
4.....	D. Humidity	4. A critical factor to control fermentation
5.....	E. Reddish-brown	5. Undergoes oxidation
6.....	F. Green Tea	6. The color change during fermentation
	G. Black tea	
	H. Air flow	

3. Fill in gaps by choosing the appropriate word from the highlighted ones reflecting on fermentation of tea leaves: **oxidation, two, Temperature, four, humidity reddish-brown, heat, five, oils**

- The fermentation process of tea leaves is also known as _____.
- During fermentation, tea leaves change from green to _____ in color.
- _____ and _____ are two key environmental factors that must be controlled during the fermentation process.
- Rolling withered leaves also helps to release essential _____ that contribute to the tea's aroma and flavor.
- The fermentation process is stopped by applying _____, which halts the oxidation process.

4. The following statements are related to rolling and fermentation of tea leaves. Read them carefully and answer by **True** if the statement is correct or **False** if it is wrong.

- Fermentation in tea production involves microbial activity
- Rolling of green tea leaves is mainly done to release essential oils and stop fermentation
- Rolling withered tea leaves initiates the oxidation process, which is crucial for developing flavours in black tea.

- iv. Rolling the tea leaves before fermentation helps initiate the oxidation process.
- v. The process of stopping fermentation by applying heat is called "drying."

Practical assessment

AB Tea cooperative is a company that produces black tea and green tea. It wishes to hire a technician who is skilled in fermenting tea leaves which will be used for producing black tea. The manager of the company requests you to ferment rolled tea leaves which will be used for producing black tea and orthodox tea.



Reference

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Learning Outcome 3: Dry fermented and steamed tea leaves



Indicative contents

3.1 Regulation of steam

3.2 Controlling drying parameters

3.3 Checking tea quality

Key Competencies for Learning Outcome 3: Dry fermented and steamed tea leaves.

Knowledge	Skills	Attitudes
✓ Description of factor to consider when regulating steam ✓ Description of drying methods ✓ Description of physical and chemical change during drying ✓ Description of drying fault in tea leaves processing	✓ Regulating steam ✓ Drying fermented and green tea leaves ✓ Testing moisture content	✓ Being vigilant when regulating steam ✓ Being careful while drying fermented and green leaves ✓ Being attentive when testing moisture content



Duration: 15 hrs

Learning outcome 3 objectives:



By the end of the learning outcome, the trainees will be able to:

1. Describe correctly methods of drying fermented and green leaves
2. Describe effectively factor to consider when regulating steam to dry green tea leaves
3. Regulate properly the steam while drying fermented and steamed tea leaves
4. Dry effectively green tea leaves and dhool in tea leaves processing
5. Describe correctly physical and chemical changes occurs during drying
6. Describe properly drying faults present during drying in tea leaves processing
7. Test effectively moisture content of dried tea in tea leaves processing



Resources

Equipment	Tools	Materials
• Electronic balance/scale, • Sifter, • Magnet, • Conveyors, • Fluid Bed Dryer, • Steam boiler, • Air compressor, • Moisture meter, • PPE.	• Thermometer, • cleaning tools • hygrometer	• Source of energy, • fermented tea leaves (dhool), • green tea leaves • water



Indicative content 3.1: Regulation of steam



Duration: 5 hrs



Practical Activity 3.1.1: Regulating steam to dry fermented and steamed tea



Task:

You are requested to go to tea leaves processing workshop and regulate steam

- 1: Apply safety precautions (Wear PPE)
- 2: Present out procedure of regulate steam
- 3: Referring to procedures provided in task 3 regulate steam
- 4: present your work to the trainer and the whole class. Ask for clarification where necessary
- 5: Read key reading 3.1.1 for full understanding



Key readings 3.1.1: Regulating steam to dry fermented and steamed tea leaves

The primary goal of drying green leaves is to halt enzymatic activity quickly, preventing oxidation, green tea leaves undergo a specific drying process to preserve their natural color and flavor. Fermented tea leaves undergo drying to preserve the unique characteristics developed during fermentation. Drying require different drying methods that complement their fermentation processes

- **Principles of Steam Drying**

The fundamental principle behind steam drying involves the use of saturated steam to heat the material. When steam comes into contact with the leaves, it transfers heat rapidly due to its high latent heat of vaporization. This heat causes moisture within the leaves to evaporate efficiently.

The key factors influencing this process include temperature, pressure, and humidity levels.

- ✓ **Temperature:** Higher temperatures increase the rate of evaporation but must be controlled to prevent damage to sensitive compounds in the leaves.

- ✓ **Pressure:** Operating under reduced pressure can lower boiling points, allowing for effective drying at lower temperatures.
- ✓ **Humidity:** Maintaining optimal humidity levels is crucial for preventing reabsorption of moisture during the drying process.

- **Steam Drying process of fermented and steamed tea leaves**

The steam drying process can be broken down into several steps:

- ✓ **Steam Generation:** Water is heated to produce steam. This can be done using boilers or other heating systems designed for industrial applications.
- ✓ **Steam Application:** The generated steam is introduced into a drying chamber where the leaves are placed. The design of this chamber allows for even distribution of steam around the leaves.
- ✓ **Moisture Removal:** As steam contacts the leaves, moisture evaporates and is carried away by either natural convection or forced ventilation systems within the chamber.
- **Advantages of Steam Drying**

Steam drying offers several advantages over traditional drying methods:

- ✓ **Quality Preservation:** The rapid heating minimizes degradation of sensitive compounds such as vitamins and antioxidants found in green and fermented leaves.
- ✓ **Efficiency:** Steam can penetrate materials quickly compared to hot air, leading to faster drying times.
- ✓ **Reduced Contamination Risk:** The use of steam helps sanitize the leaves by killing potential pathogens during the initial stages of heating.
- **Steam regulation procedures**
 - ✓ **Preparation of drying equipment:** ensure that steam boiler and dryers are clean and well maintained by checking blockages in the steam pipe and ensuring that heat exchangers are functioning efficiently
 - ✓ **Setting optimal temperature:** drying temperature that allow effective moisture removal. It should be set between 200 and 220°F(93-104°C)
 - ✓ **Steam generation:** steam boiler shall be activated to adequately supply steam required for drying fermented and green tea leaves, steam generated should be sufficient to maintain consistent temperature within dryer
 - ✓ **Uniform distribution of steam:** used of fans or blowers that help circulate warm air evenly, minimizing air resistance and ensuring even drying
 - ✓ **Monitoring humidity levels:** monitor humidity levels within the dryer environment. Maintaining appropriate humidity levels helps prevent

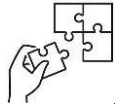
excessive moisture retention in tea leaves, which can lead to spoilage or fungal growth

- ✓ **Adjusting Airflow:** Control airflow by adjusting dampeners to optimize conditions inside the dryer. Proper airflow helps remove evaporated moisture from the dryer while allowing fresh steam to enter, thus maintaining an efficient drying environment.
- ✓ **Regular Checks on Tea Leaves:** Periodically check on the condition of tea leaves during drying to ensure they are not over-dried or under-dried. This involves assessing their color, texture, and aroma at intervals throughout the process.
- ✓ **Finalizing Drying Process:** Once moisture content reaches an acceptable level (typically around 3-5% remaining moisture), stop introducing additional steam into the system and allow residual heat to complete any final moisture removal needed.
- ✓ **Cooling Down Phase:** After achieving optimal dryness, gradually reduce temperature and allow tea leaves to cool down before packaging them for storage or sale. Rapid cooling can cause condensation which may affect quality
- ✓ **Documentation and Feedback Loop:** Document all parameters such as temperature settings, humidity levels, duration of drying, and observations made during each batch's processing. Use this data for continuous improvement in future operations by adjusting procedures based on past outcomes.



Points to Remember

- The key factors influencing steaming process include temperature, pressure, and humidity levels.
- When using steam boiler check if boiler is filled with water, and check the van if are in good working condition
- Always check the tea leaves condition to avoid that leaves can be over dried or under dried
- The primary goal of drying green leaves is to halt enzymatic activity quickly, preventing oxidation, green tea leaves undergo a specific drying process to preserve their natural color and flavor.
- Sun drying of fermented and green leaves has negative impact as it is linked with unstable weather conditions.
- Steam drying and oven drying methods is mostly used in the tea leaves processing industry as it easy to control inlet temperature that will dry leaves.



Application of learning 3.1 regulating steam

Visit the nearest tea factory where they are processing tea leaves and regulate steam for steaming tea leaves.



Indicative content 3.2: Controlling drying parameter



Duration: 5 hrs



Theoretical Activity 3.2.1: Description of physical and chemical change during drying



Tasks:

- 1: You are requested to answer to the following question:
 - i. What could be the physical and chemical changes occurred during drying fermented and steamed tea leaves?
- 2: Write your discussion findings on paper, a flip chart, a blackboard, or a whiteboard.
- 3: Present findings to the trainer or the entire class and ask questions where necessary
- 4: For more clarification, read the **key readings 3.2.1**.



Key readings 3.2.1. Description of physical and chemical change during drying

- **Physical Changes During Drying**
 - ✓ **Moisture Loss:** Freshly picked tea leaves contain a significant amount of water, typically around 70-80% by weight. During drying, this moisture evaporates, leading to a reduction in weight and volume which lead to more concentrated form of leaf materials. This loss of moisture is a primary physical change that occurs as the leaves are exposed to heat.
 - ✓ **Color Change:** As the moisture content decreases, the color of the leaves transitions from vibrant green to darker shades, often brown or black. This change is primarily due to the breakdown of chlorophyll and other pigments in the leaves. And for green tea color change from vibrant green to a more muted shade
 - ✓ **Texture Alteration:** The drying process causes the leaves to become brittle and less pliable. Initially soft and flexible, dried tea leaves can easily crumble when handled after sufficient drying has occurred.
 - ✓ **Size Reduction:** The evaporation of water leads to shrinkage in size as cell walls collapse due to loss of turgor pressure within plant cells.
- **Chemical Changes During Drying**
 - ✓ **Enzyme Inactivation:** One significant chemical change that occurs during drying is the inactivation of enzymes present in fresh tea leaves, particularly polyphenol oxidase (PPO). This enzyme is responsible for oxidation reactions that can lead to browning and flavor changes if not controlled. By applying heat during drying, these enzymes are denatured, preventing unwanted oxidation and preserving the green color and fresh flavor profile

- ✓ **Formation of Flavonoids and Other Compounds:** As oxidation progresses during drying, flavonoids such as catechins are converted into other forms like theaflavins and thearubigins. These compounds contribute not only to color but also to taste complexity, providing astringency and richness typical in black teas.
- ✓ **Polyphenol Concentration:** The concentration of polyphenols increases as water content decreases because these compounds do not evaporate with moisture. Polyphenols are responsible for many health benefits associated with green tea, including antioxidant properties.
- ✓ **Degradation of Chlorophyll:** The breakdown of chlorophyll during drying not only affects color but also impacts flavor profiles since chlorophyll contributes certain grassy notes that are diminished in black tea.
- ✓ **Volatile Compound Development:** The drying process also facilitates the formation of volatile aromatic compounds through Maillard reactions (non-enzymatic browning), which occur between amino acids and reducing sugars at elevated temperatures. These compounds enhance aroma and flavor complexity in finished black tea.
- ✓ **Loss of Nutrients:** While some nutrients may be preserved during drying, others can degrade due to heat exposure or oxidation processes, affecting overall nutritional value. Where sensitive vitamin such as Vitamin C in green tea is degraded during high temperature drying process however, careful control over temperature can minimize this loss while still achieving effective moisture removal



Practical Activity 3.2.2: Drying fermented and steamed tea leaves



Tasks:

You are requested to go to tea leaves processing workshop and drying fermented and steamed tea leaves

- 1: Apply safety precautions
- 2: Dry fermented and steamed tea leaves
- 3: present your work to the trainer and the whole class. Ask for clarification where necessary
- 4: Read key reading 3.2.2 and Ask for clarification where necessary
- 5: Perform application of learning 3.2



Key readings 3.2.1.: Dry fermented and steamed tea leaves

- **Purpose of drying green tea leaves and dhool**

- ✓ **Shelf Stability**

The primary purpose of drying tea leaves is to make them shelf-stable. Freshly harvested tea leaves contain a significant amount of moisture, which can lead to spoilage, mold growth, and degradation of quality over time. By reducing the moisture content in the leaves to approximately 2-3%, drying effectively halts oxidative processes that would otherwise lead to deterioration. This reduction in moisture not only preserves the integrity of the leaves but also extends their shelf life, allowing them to be stored for longer periods without losing quality.

- ✓ **Flavor Enhancement**

In addition to ensuring shelf stability, drying also plays a crucial role in enhancing the flavor profile of tea. This can occur through two optional processing methods known as finish-firing and roasting. Both methods involve applying heat to the tea leaves, which alters their chemical composition and enhances their flavor and aroma.

🌈 **Finish-Firing:** This method involves heating tea leaves at low temperatures for several hours, which enhances their flavor without significantly changing it.

🌈 **Roasting:** In contrast, roasting involves higher temperatures and is intended to change the flavor profile more dramatically, often adding toasted or burnt notes to the tea.

Both processes contribute to developing complex flavors that are characteristic of different types of tea.

- **Drying methods of fermented and green leaves:**

Oven drying: The method is applied on small scale it involves placing tea leaves on perforated trays in an oven where hot air circulates around them. It enhances flavor profile by facilitating chemical reactions such as pyrolysis, which alters amino acids and sugars present in tea leaves for fermented leaves. For green leaves the oven drying methods the temperature settings for green tea are generally lower than those used for fermented tea to prevent any alteration in color or flavor that might occur due to excessive heat exposure

Sun drying: is a traditional method used in the production of green tea, which involves laying freshly plucked tea leaves out under direct sunlight to dry. Leaves need to be exposed to bright sunlight for at least two days or more. However, the effectiveness of sun-drying can be significantly impacted by unstable weather conditions.

Steam drying methods: is a technique that utilizes steam as a medium to remove moisture from materials, such as fermented and green leaves. This

method is particularly beneficial in preserving the quality, flavor, and nutritional content of the leaves while ensuring effective moisture removal.

- **Purpose of regulating steam**

- ✓ **Inactivation of enzymes:** enzymatic oxidation leads to undesirable changes in flavor, color particularly in green tea. Through steaming the enzyme such as polyphenol oxidase and peroxidase are denatured
- ✓ **Flavor preservation:** the natural flavors and aromas of tea leaves are maintained. Steaming prevent development of grassy or overly bitter taste that is caused by prolonged exposure to air and light
- ✓ **Color retention:** steaming retains the bright green color for green tea product and black color for orthodox and black tea
- ✓ **Moisture control:** steaming control better moisture content within the leaves. Proper moisture level is essential for achieving optimal texture and flavor extraction

- **Monitoring of drying parameters:**

During tea drying tea is fed into the dryer, moisture content decrease with time and inlet **temperature**

section	Inlet temperature	Outlet temperature
Wet section	130-140°C	40-45°C
Middle section	120-125°C	60-70°C
Dry section	90-100°C	80-90°C

The **drying period** take around 20-25min, the **moisture range** of 2.9-3.5%



Points to Remember

- As tea leaves dry, their color changes from vibrant green to a more muted shade. This change is primarily due to the breakdown of chlorophyll, which gives fresh leaves their green color. The degradation of chlorophyll occurs as temperatures rise during drying.
- One significant chemical change that occurs during drying is the inactivation of enzymes present in fresh tea leaves, particularly polyphenol oxidase (PPO). This enzyme is responsible for oxidation reactions that can lead to browning and flavor changes if not controlled. By applying heat during drying, these enzymes are denatured, preventing unwanted oxidation and preserving the green color and fresh flavor profile.
- The drying period of fermented and green tea leaves take around 20-25min, the dried tea leaves have moisture range of 2.9-3.5%



Application of learning 3.2.

Visit the nearest tea factory where they are processing tea leaves and dry tea leaves for green and black tea making.



Indicative content 3.3: Checking tea quality



Duration: 5 hrs



Theoretical Activity 3.3.1: Description of drying fault in tea leaves processing



Tasks:

- 1: Answer to the following questions related to the description of tools and equipment used in semi-hard cheese making:
 - i. What could be drying faults that likely to occur during drying of tea leaves?
- 2: Write answers on paper, flip chart, Blackboard, or whiteboard.
- 3: Present the findings/answers to the whole class and ask clarification where necessary
- 4: Read the key readings 3.3.1. for comprehensive understanding



Key readings 3.3.1.: Description of drying fault in tea leaves processing

- **Case hardening:** this fault arises when the outer layer of the tea leaves dries too quickly while the inside remains moist. This uneven drying creates a hard-exterior shell that traps moisture within, leading to spoilage and potential mold growth over time. Case-hardened leaves may appear dry on the outside but can harbour unwanted flavors due to internal moisture retention.

✓ **Sign:**

Physical Inspection: Observing the texture of tea leaves; they may appear dry and brittle on the outside but feel soft or spongy when squeezed.

Moisture Content Testing: Utilizing moisture meters to assess the moisture levels within different parts of the leaf.

Brewing Tests: Conducting taste tests with brewed tea from affected batches can reveal off-flavors or weak infusion characteristics

✓ **Cause:**

Rapid Surface Drying: When heat is applied too quickly or unevenly, it causes rapid evaporation of moisture from the surface of the tea leaves. This creates a crusty exterior that hardens as it cools down. The inner moisture continues to exist in a liquid state due to inadequate evaporation.

the external temperature is too high or if there is insufficient airflow, moisture from within the leaf cannot escape effectively. Instead, it gets trapped inside while the outer layer dries rapidly.

- ✓ **Effect to quality of tea:** The presence of case-hardened leaves can result in poor infusion characteristics when brewed, leading to an unbalanced flavor profile and reduced aromatic qualities. Additionally, excessive moisture trapped inside can promote microbial growth or spoilage during storage
- **High firing:** drying fault that occurs when tea leaves are subjected to excessive heat during the drying phase
 - ✓ **Sign:** Teas that have been high-fired may exhibit darker colors than intended, with an appearance that suggests over-roasting. The leaf structure may also be compromised, leading to broken or fragmented leaves rather than whole, intact pieces.
 - ✓ To avoid high firing as a fault, producers must closely monitor temperature and airflow during drying processes. Techniques such as gradual heating and careful timing are essential to ensure even moisture removal without compromising flavor integrity.
- **Under firing:** occurs when tea leaves are not exposed to sufficient heat during the drying phase.
 - ✓ **Moisture Retention:** One primary effect of under firing is that it leaves excess moisture in the tea leaves. Properly fired tea should have a moisture content between 3% and 5%. If under fired, moisture levels may exceed this range, leading to a higher risk of microbial growth and spoilage.
 - ✓ **Flavor Profile Alteration:** The flavor profile of tea is largely influenced by the firing process. Under firing can result in a grassy or raw taste rather than the desired roasted or toasted notes. This alteration occurs because certain volatile compounds responsible for flavor development are not fully released or transformed during insufficient heating.
 - ✓ **Aroma Development:** Aroma compounds are also affected by under firing. The Maillard reaction and caramelization processes that contribute to complex aromas require adequate heat. Insufficient firing may lead to a lack of depth in aroma, resulting in a less appealing sensory experience for consumers.
 - ✓ **Color Changes:** The visual appeal of tea is an important factor for consumers. Under fired leaves may retain a greener color associated with unprocessed or poorly processed teas rather than developing the rich hues characteristic of well-fired varieties.



Practical Activity 3.3.2: Testing of moisture content of dried tea leaves



Task:

You are requested to go to tea leaves processing workshop test moisture content of dried tea leaves

- 1: Apply safety precautions
- 2: Test moisture content of dried tea leaves
- 3: Present your work to the trainer or the whole class.
- 4: Read key reading 3.3.2 and ask for clarification where necessary



Key readings 3.3.2: Testing of moisture content

Definition of moisture content

- **Sample Preparation:** Begin by selecting the dried tea leaves that need to be tested for moisture content. It is essential to ensure that the samples are representative of the batch being processed. Weigh a specific amount of the dried tea leaves using a digital balance. The weight should be recorded accurately, as it will be used in calculations later.
- **Initial Weighing:** The initial mass (m_{total}) of the dried tea leaves sample should be recorded before any drying process begins. This mass includes both the dry tea leaves and any moisture present in them.
- **Drying Process:** Place the weighed sample in an oven set at a temperature of 105 °C. This temperature is commonly used for moisture determination because it effectively evaporates water without significantly affecting the chemical composition of the tea leaves. Allow the sample to dry for a specified period, typically between 3 to 5 minutes, ensuring that all moisture is removed from the sample.
- **Final Weighing:** After drying, remove the sample from the oven and allow it to cool down to room temperature. Once cooled, weigh the sample again using the digital balance. Record this final mass (m_{tea}), which represents only the dry tea leaves after moisture has been removed.

- **Calculation of Moisture Content**

$$m.c = \frac{(m_{total} - m_{tea})}{m_{total}} \times 100$$

Calculate the moisture content (m.c) using the following formula:

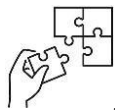
This formula calculates moisture content as a percentage based on the difference between initial and final weights relative to the initial weight



Points to Remember

- Drying fault involves case hardening, high firing and under firing
- Calculate the moisture content (m.c) using the following formula

$$m.c = \frac{(m_{total} - m_{tea})}{m_{total}} \times 100$$



Application of learning 3.3.

You are requested to go in tea leaves processing workshop and check tea quality processed



Learning Outcome 3 end assessment

Theoretical assessment

Read carefully the following statement relating to steam regulation and answer by True if it 1.is correct or False if it is incorrect

- a. In tea leaves processing one of the purposes of regulating steam is to activate enzymes
- b. The advantage of steam drying over traditional drying methods is quality preservation, efficiency and reduction of contamination
- c. The drying temperature that allow effective moisture removal is between 200 and 220°F
- d. Key factors influencing steaming process include temperature, pressure and humidity levels

2. Following are chemical changes and physical changes during drying of tea leaves, group chemical changes together and physical changes together in the space provided in table

- a. Enzyme Inactivation
- b. Size Reduction
- c. Polyphenol Concentration
- d. Color Change
- e. Loss of Nutrients
- f. Texture Alteration
- g. Volatile Compound Development
- h. Size Reduction

Chemical changes	Physical changes

3. Read carefully the following statements and choose by encircling the letter corresponding with the right answer.

- a. Following are advantages of steam drying except:

- i. Quantity preservation
 - ii. Efficiency
 - iii. Reduce contamination
- b. Physical changes during drying are following except:
 - i. Moisture Loss
 - ii. Odor Change
 - iii. Texture Alteration
 - iv. Size Reduction
- c. Following are drying fault except:
 - i. Case hardening
 - ii. High firing
 - iii. Low firing

4. Re-arrange the following steps of steam regulation to show a logic sequence by writing all the name of step.

- i. Monitoring humidity levels
- ii. Steam generation
- iii. Adjusting Airflow
- iv. Setting optimal temperature
- v. Finalizing Drying Process
- vi. Preparation of drying equipment
- vii. Cooling Down Phase
- viii. Regular Checks on Tea Leaves
- ix. Uniform distribution of steam
- x. Documentation and Feedback Loop.

Practical assessment

AMIA tea leaves processing plant is located in Nyabihu District, they process black tea, orthodox tea and green tea, they have got command of supplying their product in umushyikirano conference. Production manager of AMIA tea leaves processing plant request you to dry fermented and steamed tea leaves.



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Learning Outcome 4: Store graded tea products



Indicative contents

4.1 Grading dried tea products

4.2 Packaging graded tea products

4.3. Storing packaged tea products

Key Competencies for Learning Outcome 4: store graded tea products

Knowledge	Skills	Attitudes
• Identification of grading parameters • Description of steps involved in grading process • Description of types of tea grades	• Cupping sorted tea • Packaging graded tea • Storing packaged tea products	• Paying attention when cupping tea • Being accurate when packaging tea



Duration: 20 hrs

Learning outcome 4 objectives:



By the end of the learning outcome, the trainees will be able to:

1. Identify correctly grading parameters according to products specification
2. Cup properly sorted tea products.
3. Describe correctly steps involved in grading process
4. Describe correctly types of tea grades according to product specification
5. Package effectively graded tea according to packaging requirement
6. Store correctly packaged tea according to storage requirement



Resources

Equipment	Tools	Materials
• Electronic balance/scale, • Magnet, • Conveyors,	• Hygrometer, • Bucket, • Brooms, • Sorting bins,	• Green tea, • black tea, • orthodox tea, • cleaning agents,

• Super 3T Fiber extractor, • Pre-sorter, • Grading machine, • Packing machine, • Sealing machine, • Air compressor, • moisture meter, • PPE, • working table.	• tasting cup, • tasting bowl, • tasting spoon, • kettle, • palettes.	• Water, • Source of energy, • Packaging material, • Napkin, • Towel, • cleaning tools.
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Indicative content 4.1: Grading of dried tea products



Duration: 8hrs



Theoretical Activity 4.1.1: Identification of grading tea parameters of dried tea products



Tasks:

- 1: Answer to the following questions related to identification of grading tea parameters:
 - i. What could be grading parameters in tea processing?
 - ii. Why do we need to grade dried tea products?
- 2: Write answers on paper, flip chart, Blackboard, or whiteboard.
- 3: Present the findings/answers to the whole class.
- 4: Read the key readings 4.1.1 and ask clarification where necessary



Key readings 4.1.1.: Identification of grading tea parameters

- **Purpose of grading dried tea products**

- ✓ **Quality Assessment**

The primary purpose of grading is to assess the quality of tea leaves after they have been processed and dried. This assessment is based on several factors including size, shape, appearance, aroma, and flavor. Higher grades typically consist of whole or larger leaves that are more desirable due to their potential for better flavor extraction during brewing. For instance, whole leaf teas like Orange Pekoe (OP) are considered superior compared to smaller fragments known as fannings or dust.

- ✓ **Standardization**

Grading establishes a standardized system that allows producers and traders to categorize tea products uniformly. This standardization helps in creating a common language within the industry regarding quality levels. It enables buyers and sellers to communicate effectively about the type of tea being traded without ambiguity.

- ✓ **Market Differentiation**

Grading helps differentiate between various types of teas in the marketplace. Different grades can command different prices; higher-quality teas often fetch premium prices while lower grades may be sold at more competitive rates. This differentiation allows consumers to make informed choices based on their preferences and budget.

- ✓ **Consumer Guidance**

For consumers, grading provides guidance on what to expect from a particular tea product. Knowing the grade can help consumers select teas that align with their taste preferences—whether they prefer robust flavors from broken-leaf grades or delicate notes from whole leaf varieties.

✓ **Quality Control**

Grading also acts as a form of quality control for producers. By adhering to specific grading standards, producers can ensure consistency in their products over time. This consistency is vital for maintaining brand reputation and customer loyalty.

✓ **Economic Implications**

From an economic perspective, grading impacts trade dynamics within the global tea market. Countries known for producing high-quality teas can leverage their grading systems to enhance export opportunities and attract international buyers who seek premium products

- **Grading parameters**

- ✓ **Size**

-  **Whole Leaf Grades:** These include terms like Orange Pekoe (OP), Flowery Orange Pekoe (FOP), and Golden Flowery Orange Pekoe (GFOP). Whole leaf grades consist of intact, unbroken leaves that are generally considered higher quality due to their ability to provide a more nuanced flavor profile when brewed.

-  **Broken Leaf Grades:** This category includes Broken Orange Pekoe (BOP) and other similar classifications. Broken leaf teas consist of larger fragments that still resemble whole leaves but have been torn or fragmented during processing. While they may not be as high in quality as whole leaf grades, they can still produce robust flavors due to increased surface area.

-  **Fannings:** Fannings are small pieces of tea that result from the sorting process after higher grades have been collected. They are often used in tea bags because they brew quickly and produce a strong cup of tea. Although fanning are typically considered lower quality than whole or broken leaf grades, they can still offer good flavor depending on their origin and processing.

-  **Dust:** Dust refers to the smallest particles created during the sorting and crushing processes. It is often found at the bottom of packaging and is commonly used in commercial tea bags for its ability to brew rapidly and create a strong infusion. However, dust is generally regarded as the lowest grade in terms of quality

- ✓ **Density**

 **Whole Leaf vs. Broken Leaf:** Whole leaf teas are typically less dense than broken leaf teas. Whole leaves maintain their structure and are often larger, allowing for a slower infusion process that can lead to a more nuanced flavor profile. In contrast, broken leaves are denser due to their smaller size and fragmented nature, which allows them to steep more quickly and release flavors rapidly.

 **Fannings and Dust:** Fannings are finely broken tea leaves that have a higher density compared to whole leaves but lower than dust. They are commonly used in tea bags because they brew quickly, producing a strong cup of tea with higher levels of astringency. Dust is even finer than fannings and has the highest density among these grades; it brews almost instantaneously but may lack complexity in flavor compared to whole-leaf teas.

 **Impact on Brewing:** The density of tea leaves directly impacts how they interact with water during brewing. Denser teas like fannings or dust will extract flavors more quickly due to their increased surface area relative to volume, leading to stronger brews in shorter steeping times. Conversely, less dense whole-leaf teas require longer steeping times to fully extract their flavors.

 **Quality Indicators:** While density is an important factor in determining how a tea will taste when brewed, it does not necessarily correlate with quality alone. High-quality whole leaf teas may have lower density but offer complex flavors that develop over time during steeping. Therefore, while density is an essential parameter in grading black tea, it should be considered alongside other factors such as aroma, appearance, and taste.

✓ **Surface characteristics of particles**

The texture of tea particles can vary from smooth to rough, influencing how they interact with water during steeping. A rougher surface may enhance the interaction between water and tea compounds, potentially leading to improved flavor release.



Theoretical Activity 4.1.2: Description of steps involved in grading process



Tasks:

- 1: Answer to the following questions related to identification of grading tea parameters:
 - i. What do you understand by grading process?
 - ii. What could be steps involved in grading process?
- 2: Write answers on paper, flip chart, Blackboard, or whiteboard.
- 3: Present the findings/answers to the whole class.
- 4: Read the key readings 4.1.2 and ask clarification where necessary



Key readings 4.1.2.: description of steps involved in grading process

- **Fiber extraction/removal**

Fiber extraction is a crucial process in tea manufacturing, particularly in the production of CTC (Crush, Tear, Curl) and Orthodox teas. The primary goal of fiber extraction is to remove unwanted fibrous materials from the tea leaves while **preserving the quality and flavor of the tea**. This process **enhances the final product's taste and appearance, making it more appealing to consumers**.

- **Sorting/cake and ball removal**

Removal of cake and ball shapes during tea processing involves careful handling techniques aimed at preserving quality

Properly removing cakes and balls during tea processing is crucial for:

- ✓ Flavor Development
- ✓ Quality Control (Prevent loss of essential oils)
- ✓ Storage Efficiency (facilitate easier storage and transportation)

- **Grading/assigning grades**

Grading is essential for both producers and consumers as it provides insight into the quality and characteristics of different types of tea. While grading systems may vary between regions and producers, they serve as a useful tool for evaluating and comparing teas across various markets.



Theoretical Activity 4.1.3: Description of types of tea grades



Tasks:

- 1: Answer to the following questions related to description of types of tea grades:
 - i. Identify type of tea grade according to tea products
- 2: Write answers on paper, flip chart, Blackboard, or whiteboard.
- 3: Present the findings/answers to the whole class.
- 4: Read the key readings 4.1.3 and ask clarification where necessary.



Key readings 4.1.3.: Description of types of tea grades

- Grades in green tea

Category	Grades	Nomenclature	Wire Mesh (Stainless Steel)Size	Thickness of Wire SWG	Primary density in cubic centimeter(cc) for net 100 gm. of tea	Secondary density in cubic centimeter(cc) for net 100 gm. of tea
CTC Broken leaf	FP	Flowery Pekoe	Through 6, above 8	Mesh 6xSWG 18	-	-
	BPS	Broken Pekoe Souchong	Through 6, above 8	Mesh 6 x SWG 20 Or Mesh 8x SWG 22	300	320
	PEKOE	Pekoe	Through 8, above 10	Mesh 8 x SWG 20 to 22	-	-
	BOPL	Broken Orange Pekoe Large	a) Through 8, above 10 Or (b) Through	(a) Mesh 10 x SWG 24 Or(b) Mesh 10	-	-

			10, above 12	x SWG 22 to 23			
	BOP	Broken Orange Pekoe	(a) Through 10, above 12 Or (b) Through 12, above 14	(a) Mesh 10 X SWG 22 (b) Mesh 12x SWG 23 to 25	280	300	
CTC Fanning	BOPsm	Broken Orange Pekoe small	(a) Through 10, above 12 Or (b) Through 12, above 14	(a) Mesh 12 x SWG 24 (b) Mesh 14 x	270	295	
	BP	Broken Pekoe	(a) Through 12, above 18 Or (b) Through 14, above 18	(a) Mesh 18 X SWG 26 (b) Mesh 14 x SWG 24 (c) Mesh 18 X SWG 26	265	275	
	BPsm	Broken Pekoe small	Through 18, above 20	Mesh 18 x SWG 27 to 28	-	-	
	OF	Orange Fanning's	(a) Through 18, above 24 Or (b) Through 20, above 24	(a) Mesh 24 x SWG 28 Or (b) Mesh 20 x SWC 28 to 30	255	270	

	PF	Pekoe Fanning's	(a) Through 18, above 24 Or(b) Through 20, above 24	(c) Mesh 24 x SWG 28 Or(d) Mesh 20 x SWC 28 to 30	255	270	
	BOPF	Broken Orange Pekoe Fannings	(a) Through 18, above 24 Or(b) Through 20, above 24	(a) Mesh 24 x SWG 28 Or (b) Mesh 20 x SWC 28 to 30	-	-	
CTC Dust	PD	Pekoe Dust	Through 24, above 30	Mesh 30 x SWG 28 to 35	230	240	
	D	Dust	Through 30, above 40	Mesh 50 x SWG 37	210	215	
	CD	Churamani Dust	Through 40, above 50	Mesh 50 x SWG 37	210	215	
	RD	Red Dust	Through 30, above 40	Mesh 50 x SWG 30 to 35			
	GD	Golden Pekoe	Through 50	Mesh 50 x SWG 36	-	-	
	SRD	Super Red Dust	Through 40, above 50	Mesh 50 x SWG 36	-	-	
	FD	Fine Dust	Through 50	Mesh 50 x SWG 37	-	-	

	SFD	SSuper Fine Dust	Through 50	Mesh 50 x SWG 38	-	-	
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- **Grade in black tea**

- ✓ BP - Broken Pekoe,
- ✓ PF - Pekoe Fannings,
- ✓ PD -Pekoe Dust,
- ✓ F - Fannings,
- ✓ OF - Orange Fannings,
- ✓ GOF - Golden Orange Fannings,
- ✓ D - Dust,
- ✓ D1 - Dust 1,
- ✓ D2 - Dust 2,
- ✓ RD - Red Dust

- **Grade in orthodox tea**

Type of Tea	Grade name	Nomenclature
Whole Leaf	FP	Flowery Pekoe
	FTGOP	Fine Tippy Golden Flowery Orange Pekoe
	TGFOP 1	Tippy Golden Flowery Orange Pekoe
	GFOP	Golden Flowery Orange Pekoe
	FOP	Flowery Orange Pekoe
	OP	Orange Pekoe
Broken	BOP1	Broken Orange Pekoe one
	GFBOP	Golden Flowery Broken Orange Pekoe
	BPS	Broken Pekoe Souchong
	GBOP	Golden Broken Orange Pekoe
	FBOP	Flowery Broken Orange Pekoe
	BOP	Broken Orange Pekoe
Fannings	GOF	Golden Orange fannings
	FOF	Flowery Orange Fannings
	BOPF	Broken Orange Pekoe Fannings
Dust	OPD	Orthodox Pekoe Dust
	OCD	Orthodox Churamani Dust
	BOPD	Broken Orange Pekoe Dust
	BOPFD	Broken Orange Pekoe fine Dust
	FD	Fine Dust
	D-A	Dust A

	Spl. Dust	Special Dust
	G.Dust	Golden Dust
	OD	Orthodox Dust



Practical Activity 4.1.4: Sensory evaluation of sorted tea

Task:

You are requested to go to tea leaves processing workshop to cup sorted tea

1: Apply safety precautions

2: cup sorted tea

3: Present your work to the trainer or the whole class.

4: Read key reading 4.1.4 and ask for clarification where necessary



Key readings 4.1.4: Sensory evaluation

- **Cupping**

Cupping, or tea tasting, is a standardized method for evaluating tea quality by assessing its appearance, aroma, flavor, and texture. The process is critical for quality control, grading, and blending. Here's an overview of the **cupping standard for tea products**:

- **Tea Selection & Preparation**

- ✓ **Tea Amount:** Usually, 2-3 grams of dry tea is used per sample.
- ✓ **Water Temperature:** Depending on the tea type, water temperature varies:

✚ Green tea: 70-80°C (158-176°F)

✚ Black tea: 90-100°C (194-212°F)

- ✓ **Steeping Time:** 3-5 minutes for most teas, but it may vary by type.

- **Evaluation Criteria**

The primary attributes evaluated during tea cupping include:

- ✓ **Dry Leaf**

✚ **Appearance:** Uniformity in size, shape, and color.

✚ **Aroma:** Freshness, intensity, and any specific scent notes (e.g., floral, woody).

✓ **Liquor (Brewed Tea)**

✚ **Color:** Clear and bright without cloudiness; tea type influences the expected color.

✚ **Aroma:** Assessed immediately after brewing and just before tasting, noting the complexity and intensity.

✚ **Taste:** The primary assessment involves:

- **Body:** Fullness or richness of the tea (thick or thin feel).
- **Flavor:** Includes sweet, sour, salty, bitter, and umami elements, as well as distinct flavor notes.
- **Balance:** Harmonious interaction between taste elements.
- **Aftertaste:** Duration and pleasantness of the lingering flavor.

✓ **Wet Leaf (Infused Leaves)**

✚ **Appearance:** The uniformity of size and shape, and whether the leaves unfurl completely.

✚ **Aroma:** After steeping, the leaves should retain their aroma and reflect the quality of the tea.

• **Tasting Process**

- ✓ **Slurping:** The tea is slurped from the spoon to aerate it, ensuring the aroma reaches the nose while the taste spreads across the palate.
- ✓ **Spitting:** Tasting may involve spitting out the tea to avoid overconsumption and palate fatigue.

• **Scoring**

Teas are often rated on a scale (e.g., 1-100) for each attribute. A higher score represents a higher-quality tea. A typical evaluation form includes sections for dry leaf, liquor, aroma, flavor, and overall impression.

Attribute	Max Points	Parameter to taste
Dry Leaf	5-20	Appearance (uniformity in size, shape and color), Aroma (fresh, stale)
Liquor Appearance	5-10	Clarity (clear, not cloudy) Color (golden for black tea, pale green for green tea)
Aroma	10-20	Intensity (how pronounced the aroma is), complexity (range of aromatic notes), freshness
Flavor	30-40	Balance (sweetness, bitterness, astringency, umami), Complexity (presence of multiple flavor notes), Richness (intensity of flavor), smoothness
Body/Mouthfeel	5-10	Thickness, texture
Aftertaste	10-15	Length, pleasantness
Wet Leaf	5-10	Appearance, aroma
Total Score	100	

✓ **Grade Based on Score**

Once the scores are calculated, the tea is often assigned a grade:

- ✚ **95-100:** Exceptional quality, complex, and balanced.
- ✚ **85-94:** High-quality tea with good flavor and aroma.
- ✚ **75-84:** Average to good quality, with some minor flaws.
- ✚ **65-74:** Fair quality, possibly unbalanced or with noticeable flaws.
- ✚ **Below 65:** Poor quality, lacking in key attributes.

- **Special Considerations**

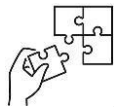
- ✓ **Consistency:** Ensure consistency in preparation for fair comparison.
- ✓ **Environment:** A neutral setting, free from strong odors or distractions, ensures accurate results.

These standards ensure objectivity when evaluating tea, providing a comprehensive view of its quality and characteristics.



Points to Remember

- Tea grades are different according to the tea products
- Tea is graded based on size ,density, surface characteristics of particles
- Grading progress involve fiber extraction, sorting by removing cakes and ball, grading by assigning grades
- Cupping standard for tea products involve tea selection and preparation, evaluation criteria
- Tasting process include slurping and spitting



Application of learning 4.1.

You are requested to go in tea leaves processing laboratory and cup the sorted tea products



Indicative content 4.2: Packaging of graded tea products



Duration: 6 hrs



Practical Activity 4.2.1: Packaging of graded tea products



Task:

- 1: You are requested to go to tea leaves processing workshop to package graded tea products
- 2: Apply safety precautions
- 3: package graded tea products
- 4: Present your work to the trainer or the whole class.
- 5: Read key reading 4.2.1 and ask for clarification where necessary



Key readings 4.2.1.: packaging of graded tea products

- **Purpose of packaging graded tea**

Proper packaging not only preserves the quality of the tea but also plays a significant role in marketing. High-quality teas often come in visually appealing packages that reflect their premium nature. Additionally, effective packaging helps maintain freshness and extends shelf life, making it essential for both producers and consumers

- ✓ Protection
- ✓ Preservation of Grading
- ✓ Hygiene and Safety
- ✓ Extended Shelf Life
- ✓ Branding and Information
- ✓ Convenience
- ✓ Compliance with Regulations

- **Performing packaging**

- ✓ **Filling and sealing**

Filling refers to the step in which processed tea is packaged or placed into containers for storage or sale.

Filling Mechanism

 **Manual Filling:** In smaller-scale operations or artisan tea production, the filling process may be done manually. Workers will scoop or pour the tea into bags, tins, or other containers.

 **Automated Filling:** In large-scale commercial operations, automated machines are used to fill tea into bags or containers. These machines can handle various packaging formats, such as tea bags, loose-leaf pouches, tins, or bulk sacks. Automated machines improve speed, accuracy, and hygiene during the filling process.

Tea Bag Filling: For tea bags, the filling process is more specific. Modern machines automatically portion out the right amount of tea for each bag, seal the bag, and attach it to strings and labels. The type of tea bag (pyramid, rectangular, etc.) determines the exact machinery used, but the goal is to ensure each tea bag is filled with the correct weight and amount of tea leaves or fanning

Sealing: Once the tea is filled into its packaging, it is sealed to prevent contamination and exposure to air and moisture. The type of sealing depends on the packaging:

 **For tea bags,** heat-sealing or ultrasonic sealing is often used to close the bags.

 **For pouches or tins,** airtight seals or lids are used to ensure freshness.

 **Vacuum-sealing or nitrogen-flushing** is sometimes used to extend the shelf life by removing oxygen from the packaging, which helps to prevent oxidation

✓ **Labelling**

Purpose of Labelling

-  Consumer Information
-  Traceability
-  Marketing and Branding
-  Legal Compliance

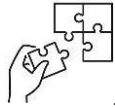
Labelling information

-  Tea Type
-  Product name
-  Grade
-  Product origin
-  Ingredients
-  Certifications
-  Manufacturing and Expiry Date
-  Allergen Warnings
-  Storage Instructions
-  Net weight



Points to Remember

- Packaging of graded tea products involves filling, sealing and labelling



Application of learning 4.2.

You are requested to go in tea leaves processing workshop and package graded tea products processed



Indicative content 4.3: Storing packaged tea products



Duration: 6 hrs



Practical Activity 4.3.1.: Storing packaged tea products



Task:

You are requested to go to tea processing workshop to store packaged tea products.

1: Apply safety precautions

2: Store packaged tea products

3: Present your work to the trainer or the whole class.

4: Read key reading 4.3.1 and ask for clarification where necessary.



Key readings 4.3.1.: Storing packaged tea products

● Description of storage requirements

✓ Storage conditions (time, temperature, relative humidity)

❖ Temperature

- ✓ **Cool Storage:** Tea should be stored in a cool environment to prevent the deterioration of flavor and aroma. High temperatures can speed up the oxidation process, particularly in green and white teas, which are minimally processed and prone to losing their freshness quickly.
- ✓ **Ideal temperature:** Between 15°C and 25°C (59°F to 77°F).
- ✓ For teas like green tea, lower temperatures are even more important because they can turn stale if stored in a warm environment.
- ✓ **Avoid Heat Sources:** Tea should be kept away from direct heat sources like sunlight, ovens, or hot storage areas, as heat can cause flavor compounds to break down.

❖ Humidity and Moisture Control

- ✓ **Dry Environment:** Tea is hygroscopic, meaning it easily absorbs moisture from the air, which can lead to mold growth, spoilage, and a loss of flavor. High humidity can also cause rehydration of the leaves, which compromises their quality.
- ✓ **Ideal humidity:** Below 60% relative humidity.
- ✓ **Airtight Containers:** Tea should be stored in airtight containers to prevent moisture absorption. Once tea leaves absorb moisture, their flavor and

aroma degrade quickly. Loose-leaf tea should be sealed tightly in containers that are resistant to humidity.

- ✓ **Dehumidified Storage Rooms:** In large-scale tea production, dehumidifiers may be used in storage areas to maintain low humidity levels, especially in humid climates.

❖ **Light Protection**

- ✓ **Avoid Direct Light Exposure:** Light, particularly ultraviolet (UV) rays, can degrade the quality of tea by breaking down its flavor compounds and causing it to become stale or lose aroma. Green tea and white tea are especially sensitive to light.
- ✓ Tea should be stored in opaque or dark-colored containers to protect it from light exposure.
- ✓ Storage areas should be kept dark, or the tea should be stored in shaded or dimly lit areas.

❖ **Air and Oxygen Exposure**

- ✓ **Airtight Sealing:** Tea oxidizes when exposed to air, particularly oxygen, which can result in flavor degradation. While black tea and oolong tea are more resilient due to their oxidized nature, green, white, and lightly oxidized teas are more sensitive to air.

-  Use vacuum-sealed or airtight containers to minimize oxygen exposure.

-  For long-term storage, some manufacturers use nitrogen flushing to replace oxygen with nitrogen inside the packaging, which prevents oxidation.

- ✓ **Frequent Opening:** Repeated opening of tea containers can lead to exposure to air, accelerating the loss of flavor and aroma. In retail settings, it is essential to limit the exposure to air by only opening containers when necessary.

❖ **Odor and Contamination Prevention**

- **Odor Absorption:** Tea easily absorbs surrounding odors, which can alter its taste and aroma. It's essential to store tea away from strong-smelling substances like spices, cleaning products, perfumes, or even other types of flavored teas.

-  Store tea in odor-neutral areas, and avoid placing it near substances that could contaminate its aroma.

-  Use separate storage areas or compartments for different types of tea to prevent cross-contamination of flavors.

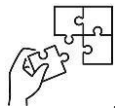
- ✓ **Stock management system (FIFO, LIFO)**

When managing the stock of tea products, companies often utilize : First-In, First-Out (**FIFO**) and Last-In, First-Out (**LIFO**)..



Points to Remember

- To manage the stock system of First In First Out (FIFO) and Last In First Out (LIFO)
- Avoid moisture content and light in store room.



Application of learning 4.3.

Visit tea leaves processing factory and store packaged tea products processed



Learning outcome 4 end assessment

Written assessment

1. In the table below, match the following attribute for sensory evaluation in **Column B** with their corresponding parameter to taste in **Column C** by writing the letter corresponding to the right answer in the provided space in **Column A**.

Column A	Column B	Column C
1.....	1) Dry Leaf	A) Thickness, texture
2.....	2) Body/Mouthfeel	B) Intensity, complexity
3.....	3) Liquor Appearance	C) Appearance (uniformity in size, shape and color), Aroma (fresh, stale)
4.....	4) Aftertaste	D) Balance (sweetness, bitterness, astringency, umami), Complexity
5.....	5) Aroma	E) Clarity (clear, not cloudy) Color(golden for black tea, pale green for green tea)
		F) Thickness, texture

2. Following statements are related to cupping and storing of tea products answer by true if the statement is correct or false if the statement is not correct

- Cupping is methods for evaluating tea quality by assessing its appearance, aroma, flavor and texture
- When preparing tea for cupping, water temperature for green tea is 90-100°C
- The steeping time for most tea is 3-5 min
- Filling refers to the step in which processed tea is packaged or placed into container for storage or sale
- Once tea is filled into packaging material it is sealed to prevent contamination and exposure to air and moisture

3. Arrange in correct order the following steps of cupping tea by writing the all name of step.

- Evaluation Criteria
- Tea Selection & Preparation
- Special Considerations

4. Scoring

5. Tasting Process

4. Read carefully the following statements, choose and write the letter corresponding with the right answer.

i. During tea selection and preparation for cupping, the following are preparation conditions involved except

- a) measure 2-3 gr of dry tea
- b) boil water at temperature 90°C-100 °C
- c) steep tea for 15-10 min

ii. The primary attributes evaluated during tea cupping include:

- a) dry leaf
- b) liquor
- c) infused leaves
- d) all are correct
- e) a, and b are correct

iii. The storage condition of tea involves:

- a) Humidity
- b) Light protection
- c) Air and oxygen exposure
- d) Temperature
- e) All are correct
- f) A and d are correct

5. Write following term used in stock management in full word

- a. FIFO
- b. LIFO

Practical assessment

AMIA tea processing plant located in Musanze district process green tea, black tea and orthodox tea, they has process tea that will be exported in Mombassa. Production manager requested you to store graded tea products.

Task

1. Graded dried tea products
2. Package graded tea products
3. Store packaged tea products



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