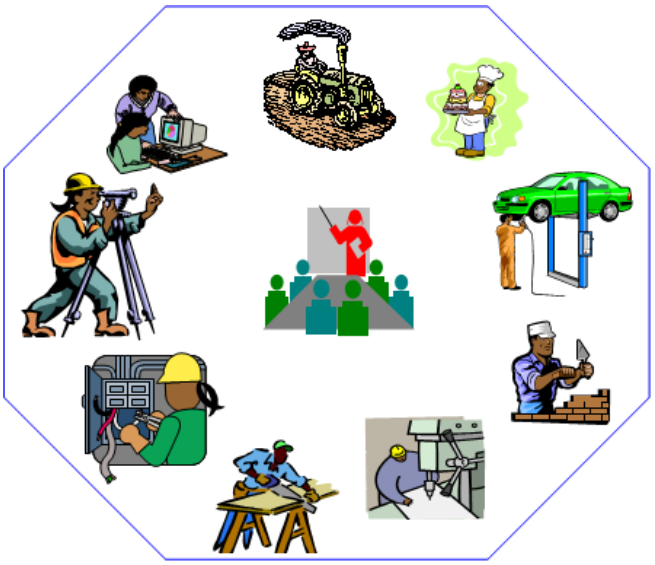
Meat and meat products processing

Level-III



Based on May 2021, Version 1 occupational standards

Module Title: - Preparing dried meat

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LG 55	LO1- Select and prepare meat for drying

Instruction sheet

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

- Selecting meats
- Inspecting meats for defects
- Identifying and taking corrective action
- preparing and storing Meat

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

- Select meats
- Inspect meats for defects
- Identify and taking corrective action
- prepare and storing Meat

Learning Instructions:

1. Read the specific objectives of this Learning Guide
2. Follow the instructions described below
3. Read the information written in the “Information Sheets” Try to understand what are being discussed Ask your trainer for assistance if you have hard time understanding them
4. Accomplish the “Self-checks” which are placed following all information sheets
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work (You are to get the key answer only after you finished answering the Self-checks)
6. If you earned a satisfactory evaluation proceed to “Operation sheets
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Information Sheet 1- Selecting meats for drying

1.1. Introduction

Meat drying is a complex process with many important steps, starting from the slaughtering of the animal, carcass trimming, and the selection of the raw material, proper cutting and pre-treatment of the pieces to be dried and proper arrangement of drying facilities. This practice describes simple techniques for dried meat production.

1.2. Selection of meat for drying

As a general rule only lean (thin) meat is suitable for drying. Visible fatty tissues following to muscle tissue have a unfavorable effect on the quality of the final product. Under processing and storage conditions for dry meat, rancidity quickly develops, resulting in flavor deterioration.

Figure 1 best selected cut of meat for drying

Dry meat is generally manufactured from bovine meat although meat from camels, sheep and goats are used. The meat best suited for drying is the meat of a medium-aged animal, in good condition, but not fat Carcasses have to be properly cut to obtain meat suitable for drying

- **Trimming**

After the quarters are suspended so that they do not touch the floor or anything around them, they are trimmed. Careful trimming is very important for the quality and shelf-life of the final product.

The first step in trimming is to remove (with a knife) all visible contamination and dirty spots washing these areas will spread bacterial contamination to other parts of the meat surface without cleaning the meat. After completing the necessary cleaning of the meat surfaces, knives and hands of personnel must be washed thoroughly.

Using a sharpened knife, the covering fat from the external and internal sides of the carcass and the visible connective tissue, such as the big tendons and superficial fasciae, are carefully trimmed off (see Figure 2)

Figure 3 Trimming

1.3. Preparation of meat for drying

The meat is exposed to the open air and intermittent solar radiation and quickly loses substantial amounts of its tissue moisture. The drying process will be faster the shorter the distance from the center of the meat piece to its surface In order to accelerate the drying process in particular from the inner layers of the meat; it is therefore common practice to cut the meat in narrow strips or in flat pieces. Recommended shapes for meat pieces to be dried are:

- Strips with a rectangular cross-section of 1 x 1 cm
- Flat- or leaf-shaped pieces with cross-sections of 0,5cm x 3 to 5cm

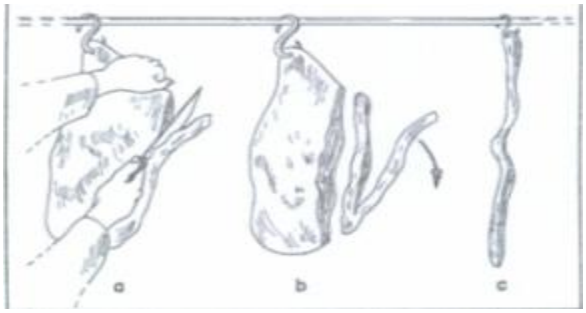

Figure 4 special cutting techniques to obtain long strip for suspension

Figure 5 cutting of meat in strip

Figure 6 Cutting of meat in flat piece in preparation for drying

1.4. Types of meat suitable for drying

Meat drying is a simple but efficient food preservation activity. Dried meat can be stored under ambient temperatures for many months. Due to the low water content, microbial spoilage of the muscle proteins can be safely prevented. However, deterioration of adhering fatty tissue through rancidity cannot be stopped. It is therefore advisable to use lean meat only. Beef and buffalo meat as well as goat and certain game meats (deer, antelopes) are best suited. The same applies to meat of livestock used in some regions for meat production, such as camels or yaks. The suitability of mutton is ranked slightly lower. Pork, even from very lean muscle parts, is less suitable, as it contains higher amounts of intramuscular and mostly invisible intramuscular (within the muscle cells) fat, which prone to oxidation and hence turns quickly rancid

Self-check 1	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What are the recommended shapes for meat pieces to be dried? (5 point)
2. Preparation of meat for drying? (3points)
3. Why dried meat can be stored under ambient temperatures for many months?
4. .What is drying meat ?

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet -2 inspecting meat

2.1. Inspecting meat

Meat inspection is designed to determine the health of animals both prior to death (ante mortem) and after death (post mortem). Once the meat is approved for human consumption, the inspection stamp can be made along the length of the carcass. The stamp appears as a blue circle with the word “Canada” inside the circle rim, with a crown in the centre and the plant number at the bottom.

2.2. Purpose of meat inspection

The purpose of meat inspection has been summarized by as:

i) Removal of completely abnormal products from the meat chain;

ii) Prevention of the distribution of infected meat that could give rise to disease in humans; and

iii) Assistance in the detection and eradication of certain diseases of livestock

As such, meat inspection plays a significant role in both animal and human health protection . Selection and grading of manufacturing-meat from cattle Similar to pork, valuable meat cuts (choice cuts) from beef are usually excluded from further processing and marketed as fresh meat.

2.3. Most common fresh meat cuts are

- tenderloin
- Sirloin
- Topside
- Silverside
- Rump and
- Parts of the neck and shoulder (Fig 1,2)

The rest of the carcass meat as well as trimmings derived during the preparation of the above mentioned choice cuts are used as manufacturing-meat for all types of processed products

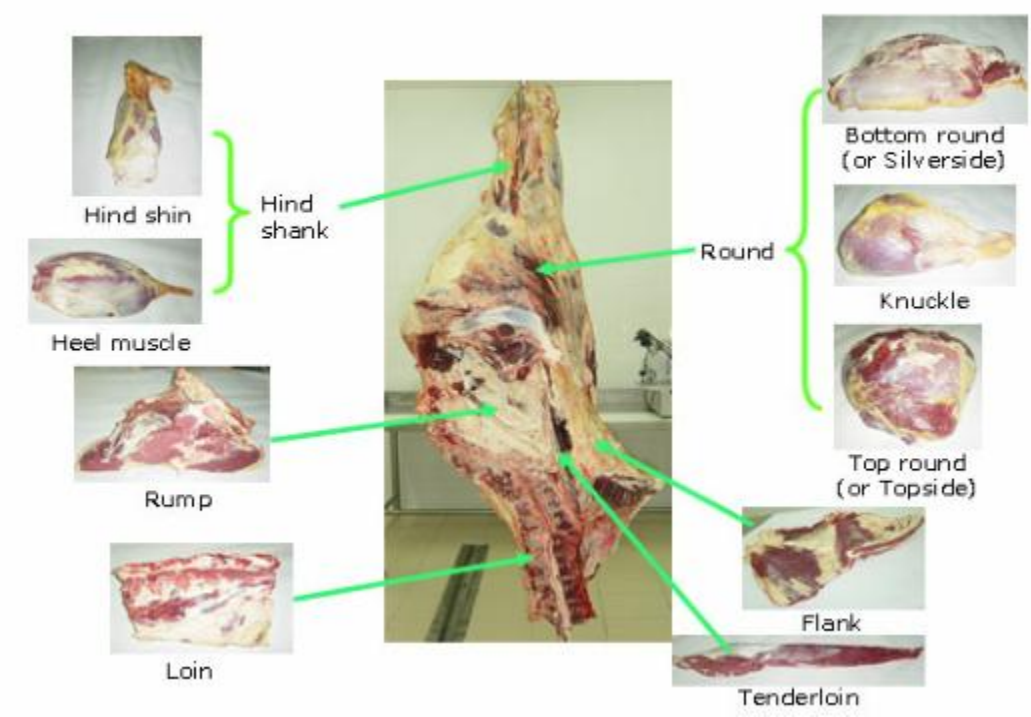

Figure.7 Parts of beef meat

The functional properties of beef are influenced to a large extend by the age of the animal Meat from younger animals has a much higher water binding capacity than meat derived from a carcass of an older animal

For this reason meat from younger animals should be used for products requiring high binding and water holding capacity and meat from older animals is more suited for products undergoing a drying and fermentation process

Similar to the grading scheme for pig meat, a simple scheme is proposed for the selection and grading of beef, which is considered suitable for small and medium operations.

For beef, three grades of manufacturing meat (Fig1-3) are sufficient to cater for the needs of small to medium-size manufacturing Beef fat and skin are usually not a raw material for meat processing

Grading scheme for manufacturing-meat from cattle

Grade beef 1(B1) Lean beef without visible fat and connective tissue

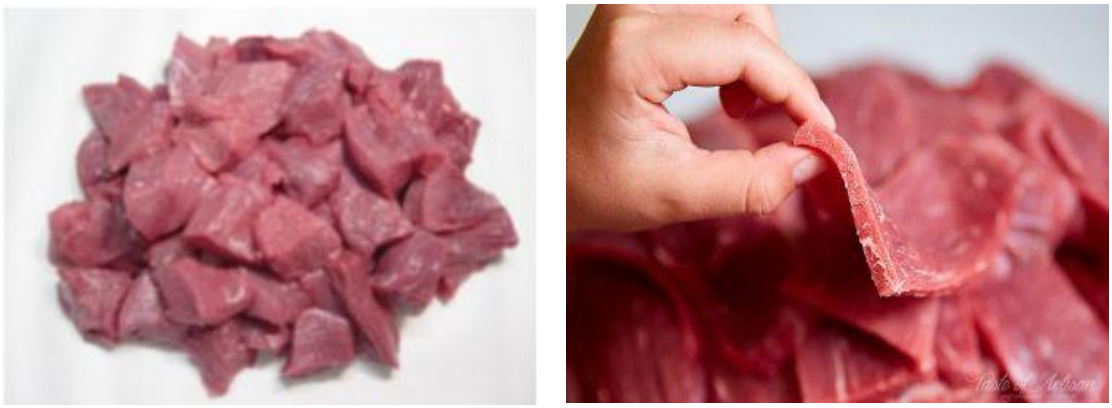

Figure 8 lean beef without visible fat & connective tissue

Grade beef 2 (B2) Beef with less than 10% (visible) connective tissue and less than 10% fat

Figure 9 beef meat with less than 10% visible connective tissue & fat

Grade Beef 3(B3) Beef trimmings with up to 20% (visible) connective tissue and 20% fat

Figure-10 Beef meat with up to 20% (visible)

2.4. Grading scheme for beef is proposed:

GRADE Beef 1 Lean muscle meat with all visible fat and connective tissue removed The meat is derived from the major muscles of the fore and hindquarter with the exception of shanks and belly muscles.

GRADE Beef 2(B2) Muscle meat trimmings with small quantities of connective tissue (<10%) and body fats (<10%) .Meat parts used for this grade are mainly obtained as muscle trimmings from the manufacture of primal meat cuts and from smaller lean muscles which are not sold as special cuts

GRADE Beef 3(B3) Muscle meat trimmings with connective tissue (<20%) and body fats (<20%) . For this grade, small meat trimmings removed from bones during deboning, flanks and shanks are used As this meat is relatively high in connective tissue and fat, it is only used for the manufacture of finely chopped meat mixes It is not suitable for use as coarse parts in meat mixes due to its tough texture.

Self-check 2	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What is the purpose of inspecting of meat in drying process? (2 point)
2. What is meat inspection mean define it?(3 point)
3. Write three grading of meat? (5points)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet -3 identifying defects and taking corrective action

3.1. Meat spoilage through micro-organisms

Meat spoilage bacteria will grow if temperatures are not kept in the

- Cooling (-1°C to +4°C) or
- Freezing (below -1°C) range

Not all bacteria which contaminate meat will behave in the same way Some may multiply already at temperatures at around 10°C, others at higher temperatures, for example 30°C Most bacteria can optimally grow in the range between 30°C and 37°C.

3.2. Some bacteria that attack the products results

- The protein portion –results the production of unpleasant putrefactive odors
- The carbohydrate components – causing intensive sour taste or acidty
- The fat portion - producing rancidity

These various bacterial impacts result in meat spoilage or decomposition Spoilage of meat and meat products causes serious financial losses for the meat industries as such products, due to their sensory changes exposed through unpleasant smell and taste are unfit for human consumption But spoiled meat, if accidentally ingested, is usually the cause for illness in consumers.

3.3. Impact of bacteria on meat

- **Meat spoilage**
  - ✓ Putrefaction- breakdown of protein example slime
  - ✓ Sourness- production of lactic acid example- discoloration
  - ✓ Rancidity (breakdown of fats)

- **Meat poisoning**
  - ✓ Infection (ingested with contaminated meat, bacteria multiply and procedure toxins in consumer's organism, cause illness)
  - ✓ Intoxication (microorganism-bacteria mold-multiply in contaminated meat and produce toxins, ingestion by consumer, causes illness.

3.4. Principles of meat hygiene,

Prevent microbial contamination of raw materials, intermediate (semi-manufactured) goods and final products during meat product manufacture through absolute cleanliness of tools, working tables, machines as well as hands and outfits of personnel.

- Minimize microbial growth in raw materials, semi-manufactured goods and final products by storing them at a low temperature
- Reduce or eliminate microbial contamination by applying heat treatment at the final processing stage for extension of shelf life of products (except dried and fermented final products, which are shelf-stable through low aw and pH)4

For the sanitary quality and safety related to meat processing, two useful schemes1 can be applied known as

- Good Hygienic Practices (GHP) and
- Hazard Analysis and Critical Control Point (HACCP) Scheme

3.5. Good Hygienic Practices/GHP

Follows general hygienic rules and applies recognized hygienic principles as well as laws and regulations issued by the competent authorities, referring to meat and meat products, equipment, premises and personnel. **GHP for meat processing plants refers principally to:**

- Appropriate functional plant layout and sanitary design of equipment
- Raw materials that meet hygiene quality standards
- Processing methods that allow safe handling of meat
- Appropriate waste and pest control measures

- Appropriate sanitation procedures (cleaning and disinfection)
- Compliance with potable water criteria
- Functional cold chain
- Regular examination of health and personal hygiene of staff
- Regular training of staff on hygiene requirements

3.6. Principles of personal hygiene

- Wear clean protective clothes
- Washing hands before starting work
- Repeatedly washing hands during work
- No finger rings, watches, bracelets
- Access to production areas with working clothes only
- Cleaning/disinfection of hands/tools/clothes if there was contact with highly contaminated subjects or abnormal animal parts likely to contain pathogens
- Fresh wounds through knife cuts etc must be covered by a water tight bandage
- Strict toilet hygiene must be observed (removal of apron, hand washing and hand disinfection to reduce risk of spread of Salmonella
- Toilets must be kept clean and must not have direct access to production areas
- Periodic medical examination of staff.

Figure 11 Good Hygienic Practices/GHP

3.7. Hazard Analysis and Critical Control Point Scheme (HACCP)

HACCP are factory and product specific strictly sanitary control schemes that shall prevent, detect, control and/or reduce to save levels accidentally occurring hazards to consumers' health

Specifically for meat processing plants, such hazards may cause failures such as:

- Batches of incoming raw meat materials with abnormal tissues or heavy contamination,
- Breakdowns in refrigeration,
- Failure in cooking/sterilization operations,
- Abnormal pH or aw in raw or finished products,
- Errors in levels of application of curing salts and other additives,

- Technical problems in sealing of vacuum packages or cans with the risk of recontamination

Basic elements of HACCP in meat processing plants

A. Hazard analysis and risk assessment

Example

Physical hazards: Rests of unwanted materials (glass, bone fragments, animal teeth, metal fragments, broken knife blades, needles, plastics, stones)

Biological hazards:

- Parasites
- bacteria
- molds
- viruses

Chemical hazards:

- Contaminants
- Residues
- Food additives with risk of overdoses

B. Identification of Critical Control Points (CCP) Such examples are:

- Potable water outlets,
- Hot water container for tool disinfection ("sanitizers"),
- Cleaning and disinfection equipment, chemicals and methods
- Sanitation measures (e g periodic cleaning and disinfection of meat cutting boards)
- Personal hygiene
  - ✓ Specific preventive measures to avoid cross contamination (e g plant internal transports of raw materials and finished products must not cross each other)
  - ✓ Specific food handling procedures (e g meat containers must not directly be placed on the floor, but on stands, pallets etc)

C. Establishment of Critical Limits for each CCP

D. Establishment of a monitoring system for each CCP

- Physical and chemical pattern to be instantly measured or monitored in meat processing lines include: Temperature, Time, pH Moisture
- Reject incoming meat with too high internal temperatures
- Adjust cooking and sterilization parameters (temperature/time)
- Reject meat with too high pH
- Adjust quantity of curing substances

E. Establishment of verification procedures

F. Establishment of documents and records

This documentation includes amongst others

- Certification on receipt of raw meat materials and non-meat ingredients documenting supplier compliance with processor's specifications
- CCP determinations (for each product)
- Critical limits set and results achieved for each CCP (including possible deviations from critical limits and corrective actions)
- Modifications introduced to the system in the light of changes of technology or other developments

Self-check 3	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What are bacteria that attack the meat products results? (5 point)
2. What are hazards of meat? (3points)
3. What are examples of Establishment of corrective actions? (2point)
4. Write the elements of the hazard analyses? (2point)
5. What are the defects of meat in preparation of meat drying process?

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information Sheet -4 preparing and storing meat

4.1 Introduction

Meat is the common term used to describe the edible portion of animal tissues and any processed or manufactured products prepared from these tissues. Meats are often classified by the type of animal from which they are taken. Red meat refers to the meat taken from mammals, white meat refers to the meat taken from fowl, and sea food refers to the meat taken from fish and shellfish.

4.2 Preparation

- Preparing is important to keep your raw meat safe from harvest to processing.it helps to avoid contamination, spoilage, and bacterial growth that affect quality and health, and Because bacteria can spread easily,
- Prepare the meat on a surface that's separate from all other cooking materials.
  Keep vegetables and other ingredients away from meat, especially if you aren't cooking them together in the same dish.
- Try to use separate cutting boards, clean all cooking utensils after they touch raw meat, and use different utensils to serve food after you've prepared it.
- Jerky, dried meat can be made from almost any lean meat, including beef, pork, venison or smoked turkey breast. Raw poultry is not recommended for jerky because of the texture and flavor of the finished product.
- Remove the connective tissue and fats from the meat that is chosen to make dried product.

4.3 Always use safe handling and preparation methods.

- Wash hands thoroughly with soap and water before and after working with meat products.
- Use clean equipment and utensils.
- Keep meat refrigerated at 40ºF or slightly below; use or freeze ground beef and poultry within 2 days and whole red meats within 3 to 5 days.

- Defrost frozen meat in the refrigerator, not on the kitchen counter.

Maintain a constant dehydrator temperature of 130ºF to 140ºF. This speeds the drying process, removing water that allows microorganisms to grow and spoil the food. Do not rush the drying process by raising the temperature during drying. High drying temperatures cause 'case hardening" which traps moisture inside the food and cause spoilage.

4.4 Storing meat

Mismanagement of temperature is one of the most common reasons for outbreaks of food-borne diseases. Bacteria grow best at temperatures between 40 degrees and 140 degrees Fahrenheit, so it is important that your meat product passes through this range quickly.

Meat can be kept safe when it is hot or when it is cold, but not in between. It is best if the meat passes through this temperature range, whether being cooked or cooled, within four hours, but preferably less. Store your raw meat in a refrigerator until you begin processing it. During the processing of most meat products, it will be essential to reach an internal temperature of 160 degrees Fahrenheit, as this effectively kills pathogenic bacteria (Most, but not all, microorganisms are killed at 140 degrees Fahrenheit).

The interior of the meat can be considered sterile, or nearly so, unless it has been cut into. Prior to processing or dehydrating your jerky, it is likely you will be working with a raw meat product for a period of time. The less time you subject the meat to room or ambient temperatures, the less risk there will be in it protecting harmful microorganisms that cause spoilage. If meat is stored **below 40 degrees Fahrenheit**, most of it can be kept safe from harmful bacteria for a **short time**.

When **frozen storage**, most microorganisms that are present is merely dormant and can recover when softened. If you have thawed (soften) the meat you plan to use for

jerky, it all should be processed as soon as possible and not refrozen to use for jerky later.

Temperature remains the critical factor once you proceed to jerky production. In decades past, the standard was for the meat to be heated between 130 to 140 degrees Fahrenheit, which many dehydrators could achieve.

However, the current United States Department of Agriculture (USDA) recommendation for safe jerky making is to heat meat to **160 degrees Fahrenheit** (and poultry to **165 degrees Fahrenheit**) before the dehydrating process begins.

Reaching these temperatures will assure that the **wet heat** will **destroy any bacteria present.** Some research has shown that without reaching these temperatures before dehydrating, any bacteria present after drying become more heat resistant and may survive in sufficient quantities to create health problems later.

4.4.1 Covering/packing

Wrapping or enclosing foods in containers will help keep them fresher than if left uncovered in the refrigerator. Uncovered meat has more exposure to **oxygen**, which can cause bacteria to **multiply faster**. Oxygen also tends to dry out the meat surface much quicker.

Wrapping or containing meat serves several purposes it forms a barrier between the meat and oxygen, it prevents refrigerator odors from transferring from one food to another, and it helps prevent cross-contamination between foods that may occur through drips or touch. Outside the refrigerator, wrapped or covered meats are less exposed to flies, insects, or pets.

Figure 12 stored meat in the grosser

4.4.2 Storage & Food Safety:

- To prevent cross-contamination, in the grocery cart or in your refrigerator, always place raw beef in plastic bags to keep juices from leaking or dripping on to other food items
- Place raw beef in a cooler on ice if the estimated trip from the market to your refrigerator will last more than one hour; this is especially important in warm weather
- Raw beef should be stored in a bowl or on a platter in the bottom of the refrigerator, your refrigerator temperature should be at 40 °F or less
- Store whole-muscle fresh beef cuts for three to five days in the refrigerator
- Ground beef and variety meats such as liver, kidney and tongue can be stored

  fresh for one to two days in the refrigerator
- Use or freeze products with a “sell by” date within three to five days of purchase
- Use cooked beef that has been safely refrigerated within three to four days
- Always wash cutting boards, utensils and surfaces that have touched raw beef

with hot, soapy water, and then sanitize with 1 teaspoon of regular bleach in 1 quart of warm water.

- Washing meat before cooking it is not recommended. This can cause cross-contamination – when bacteria in raw meat spread to other foods, utensils and surfaces

Uncured, raw meat generally lasts safely for around three days in the refrigerator. If you plan to keep uncooked meat longer, freezing it is your best bet.

Seal the meat in an **airtight package** before freezing then; it can usually be frozen for at least several months.

Safe **freezing** and **refrigeration** time also depends on the storage temperature.

- Keep your freezer as close to 0°F (-17 8°C) as possible. This helps retain nutrients and keep food fresh.
- Keep your refrigerator at around 34°F (11°C), just above freezing, to effectively prolong the shelf life of foods.

Below are general guidelines for how long basic meats can be kept safely if they're stored properly.

Table1 Type of meat in refrigerator & freezer

	34°F (11°C)	0°F (-17. 8°C)
Type of meat	**Safe storage times (in the refrigerator)**	**Safe storage times (in the freezer)**
uncooked poultry	1–2 days	9 months (pieces) to 1 year (whole)
uncooked ground meat	1–2 days	3–4 months
uncooked steaks or chops	3–4 days	4–12 months, depending on the item
uncooked fish	1–2 days	6 months
cooked poultry, meat, or fish	3–4 days	2–6 months

Self-check 4	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Choose the best answer (4 point)

1. Keep your freezer as close to …… as possible. (3point)

   A.0°F (-17 8°C) B.12°C C. A & B

2. Keep your refrigerator at around 34°F (11°C), just above freezing.(3point)

   A. True B false

3. Raw beef should be stored in a bowl or on a platter in the bottom of the refrigerator. .(3point)

   A. True b. false

4. Preparation helps to avoid contamination, spoilage, and bacterial growth that affect quality of meat products.(3point)

   A. True B. false

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - blow 10 points**

LG 56	LO 2- Dry meat products

Instruction sheet

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

- Performing Pre-operational checks
- Loading drier
- Operating drier
- Maintaining records
- Empting drier

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

- Perform Pre-operational checks
- Load drier
- Operate drier
- Maintain records
- Empty drier

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Information Sheet -1 performing pre-operational checks

1.1 Introduction

1.1.1 Performing pre-operational checks

It is implemented by applying the general policy of operation. The Plant Manager/ designated personnel are responsible for the implementation, daily monitoring of the Sanitation Standard Operating Procedure (SSOP), recording the findings and any corrective actions. All records pertaining to this SSOP will be maintained on file and made available to the HACCP Coordinator. Before starting cleaning procedures, all clean up personnel must be wearing proper protective clothing, footwear, face shield, rubber gloves.

1.1.2 Pre-operation sanitation – equipment and factory

A. General Equipment Cleaning

All equipment, used for drying, will be cleaned and sanitized after production.

I. Established cleaning procedures include:

- Remove all finished products to the designated storage areas.
- Remove or cover any packaging material.
- Clean up any debris on the floor.
- Follow proper lock out procedure before equipment is disassembled, as necessary.
- Food debris is removed from equipment. Remove all garbage from the production area.
- Equipment parts are brushed where required and then rinsed with water to remove remaining food debris.
- An approved cleaning solution is applied to equipment parts/surfaces and scrubbed as need to remove soil.
- Equipment /parts are rinsed with potable water.
- Equipment/parts are inspected for cleanliness, and re-cleaned if necessary.

- Equipment/parts are sanitized with approved sanitizer solution.
- Equipment is reassembled and re-sanitized if necessary.

II. Implementation, Monitoring and Record Keeping.

The Plant Manager/designated personnel perform daily sanitation inspection after pre-operational cleaning and sanitizing. The results of this inspection are recorded on **Pre-Op log sheet**. If inspection finds that equipment is acceptably clean, then the appropriate box is checked and initialed. If corrective actions are needed, such actions needed to be completed and documented in the Corrective Action column of log sheet and signed by HACCP Coordinator/designated personnel.

III. Corrective Actions.

- When the Plant Manager/designated personnel determines that equipment or parts are not properly cleaned the equipment should be placed on hold, the cleaning procedure and inspection are repeated. The Plant Manager /designated personnel monitor the cleaning process, and re-train the employees doing the cleaning, if necessary. Corrective actions are recorded in the Action Taken column of the Pre-Op inspection sheet.

B. Cleaning of facilities, including floors, walls and ceilings

I. Cleaning procedures:

- Debris is swept up and discarded.
- Facilities are rinsed with potable water.
- Facilities are cleaned with approved detergent (Personal Protective Equipment is used when cleaning).
- Rinse
- Sanitize as required

II. Cleaning Frequency. Floors and walls are cleaned at the end of each processing day.

III..Ceilings are cleaned as needed, but at least once a month. Record the results in log sheet.

IV. Implementation, Monitoring and Record keeping.

- The Plant Manager/designated personnel perform daily organoleptic, sanitation inspection after pre-operational cleaning of facilities. The results of this inspection are recorded on log sheet. If inspection finds that the facilities are acceptably clean, then the appropriate box is checked and initialed. If corrective actions are needed, such actions needed to be completed and documented in the Corrective Action Taken column on log sheet.

V. Corrective Actions.

- When the Plant Manager/designated personnel determine that the facilities are not properly cleaned, the cleaning procedure and inspection are repeated. The Plant Manager or designate monitors the cleaning process, and re-trains the employees doing the cleaning, if necessary. Corrective actions are recorded in the Actions Taken Column on log sheet.

1.1.3. Operational sanitation – equipment and facility cleaning

C. Food processing Operations

Food processing is performed under sanitary conditions to prevent direct and cross-contamination of ingredients.

I. Established personal hygiene procedures for employees processing products includes:

- All employees handling food (meat) ingredients will wear hairnets, gloves where required during processing.
- All employees will clean and sanitize hands, knives, scoops, etc., as necessary during processing to prevent contamination of finished products.
- All equipment, tables, or scale tops are cleaned and sanitized throughout the day as needed.

- Employees will wear clean gloves when weighing the food ingredients.

II.Established procedures for food(meat) products handling and storage include:

- Smocks, and gloves, are identified and designated specifically for production area. Outer garments are maintained in a clean and sanitary manner and are changed at least daily, and if necessary, more often.
- Products containing food allergens are segregated and processed last.

III. Established procedures for insect and rodent control are:

- Insect and rodent traps will be maintained in non-food handling areas by the commercial outfit.
- All areas (dry storage rooms, coolers, production area, etc.) will be checked for visible rodent droppings and insects.

IV. Established procedures for processing different product clean-up include:

- A full cleanup will be done for the equipment and processing area, in the event that different food product is processed on the same day.

V. Implementation, Monitoring, and Record Keeping.

- The Plant Manager or designate person is responsible for ensuring that employee hygiene practices, sanitary product handling procedures, pest and rodent control and cleaning procedures are maintained during processing. The Plant Manager/designate monitors these operational sanitation procedures once during each change in product and these results are recorded on the log sheet.

- When the Plant Manager/designate identifies operational sanitation problems, he/she notifies employees to take appropriate action to correct the sanitation problems. If necessary, processing is stopped and/or employees are re-trained. Corrective actions are recorded in the Actions Taken column on log sheet and also recorded in Corrective Actions Record Book.

Self-check 1	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What is established cleaning procedures include? (3 point)
2. What are Implementation, Monitoring and Record keeping,
   In cleaning facilities, list them**?**(3points)
3. Where is the corrective action taken in Food processing Operations? (3point)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information sheet -2 Loading drier

2.1 Introduction

Loading of meat is the process of putting the slice marinated meat in plate or trays.

Putting of marinated meat is important process in drying.

Loading of marinated sliced meat laying takes place in two places, one

- loading on trays or stain less steel metal rode, and
  Loading of meat on the trolleys
- finally loading the trolley to the drier.

Figure 1 a. Trays

Figure 1b. Trolley

The drying process can be conducted in batch mode system. In batch mode, the fresh fed from the center to avoid non-uniform drying and to products are loaded after the dried product from the reduce the heat loss to the surroundings. Figure loading fish meat on solar drier

Figure 14 microwave food drier machine

Drying may be used as the only technique for production of highly dehydrated and shelf-stable end-products, as is often the case in hot areas and developing countries, where chilling and refrigeration infrastructures are lacking. Drying of meat may also be combined with other techniques such as

- smoking,
- salting,
- seasoning,
- curing and
- ripening

The choice of such combined treatment mainly aims at enhancing the organoleptic characteristics (flavor, texture) and improving the palatability of the end-product, to suit consumer requirements.

Figure 15a loading sliced meat on metal rode **Figure 15b loading meat in to drier**

Trays able to:

- should be constructed from stain less steel metal that can prevent corrosion and also
- it should be suitable for handling to move it easily on processing area.
- It should be wash or clean every day after processing of drying batch

Drying steps:

- hot steam conveyed into the dryer
- exchanged into hot dry air through the heat exchanger
- air from the fan spreads the hot air and filled the whole cabinet
- the hot dry air exchanges heat with materials
- vapor inside the chamber was taken away by the humidity removing fan
- material drying has been achieved

Figure 16 Loading of dried meat product

Self-check 2	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What is loading mean, define it?(3point)
2. When we use the tray in meat drying process technology? (4 point)
3. The loading material should be able to what? (3points)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

3.1 Introduction

Drying of meat implies the removal of water from the food. In most cases, drying is accomplished by vaporizing the water that is contained in the food, and to do this the latent heat of vaporization must be supplied.

There are, thus, two important **process-controlling factors** that enter into the unit operation of drying:

(a) Transfer of heat to provide the necessary latent heat of vaporization,

(b) Movement of water or water vapor through the food material and then away from

3.2 Drying meat-

The conventional techniques for meat drying may be used at small, semi-industrial or industrial scales. Major examples among the conventional techniques are:

- **Meat drying techniques**
  - ✓ Sun drying
  - ✓ Solar energy drier
  - ✓ multi-collector drier
  - ✓ microwave
  - ✓ hot air steam

Figure 17 flat meat pieces on drying trays

Figure 18 Sun drying by suspension practiced in a rural setting

3.3. Drying processes fall into three categories:

- **Air and contact drying**

under atmospheric pressure In air and contact drying, heat is transferred through the foodstuff either from heated air or from heated surfaces The water vapour is removed with the air

- **Vacuum drying**

In vacuum drying, advantage is taken of the fact that evaporation of water occurs more readily at lower pressures than at higher ones Heat transfer in vacuum drying is generally by conduction, sometimes by radiation

- **Freeze drying**

In freeze drying, the water vapor is sublimed off frozen food The food structure is better maintained under these conditions Suitable temperatures and pressures must be established in the dryer to ensure that sublimation occurs.

Figure 19 Microwave drier

Figure 20a Multi-collector drier

Figure 20b. Solar tunnel drier

3.4. Drying machine and operating technique

- **Tray Dryers**

In tray dryers, the food is spread out, generally quite thinly, on trays in which the drying takes place. Heating may be by an air current sweeping across the trays, by conduction

from heated trays or heated shelves on which the trays lie, or by radiation from heated surfaces. Most tray dryers are heated by air, which also removes the moist vapors.

- **Tunnel Dryers**

These may be regarded as developments of the tray dryer, in which the trays on trolleys move through a tunnel where the heat is applied and the vapours removed In most cases, air is used in tunnel drying and the material can move through the dryer either parallel or counter current to the air flow Sometimes the dryers are compartmented, and cross-flow may also be used.

- **Roller or Drum Dryers**

In these the food is spread over the surface of a heated drum The drum rotates, with the food being applied to the drum at one part of the cycle The food remains on the drum surface for the greater part of the rotation, during which time the drying takes place, and is then scraped off Drum drying may be regarded as conduction drying .

- **Fluidized Bed Dryers\hot air steam**

In a fluidized bed dryer, the food material is maintained suspended against gravity in an upward-flowing air stream. There may also be a horizontal air flow helping to convey the food through the dryer Heat is transferred from the air to the food material, mostly by convection.

- **Pneumatic Dryers**

In a pneumatic dryer, the solid food particles are conveyed rapidly in an air stream, the velocity and turbulence of the stream maintaining the particles in suspension Heated air accomplishes the drying and often some form of classifying device is included in the equipment. In the classifier, the dried material is separated, the dry material passes out as product and the moist remainder is recirculate for further drying.

- **Rotary Dryers**

The foodstuff is contained in a horizontal inclined cylinder through which it travels, being heated either by air flow through the cylinder, or by conduction of heat from the cylinder wall. In some cases, the cylinder rotates and in others the cylinder is stationary and a paddle or screw rotates within the cylinder conveying the material through.

- **Trough Dryers**

The materials to be dried are contained in a trough-shaped conveyor belt, made from mesh, and air is blown through the bed of material. The movement of the conveyor continually turns over the material, exposing fresh surfaces to the hot air

- **Bin Dryers**

In bin dryers, the foodstuff is contained in a bin with a perforated bottom through which warm air is blown vertically upwards, passing through the material and so drying it

- **Belt Dryers**

The food is spread as a thin layer on a horizontal mesh or solid belt and air passes through or over the material. In most cases the belt is moving, though in some designs the belt is stationary and the material is transported by scrapers

- **Vacuum Dryers**

Batch vacuum dryers are substantially the same as tray dryers, except that they operate under a vacuum, and heat transfer is largely by conduction or by radiation. The trays are enclosed in a large cabinet, which is evacuated. The water vapor produced is generally condensed, so that the vacuum pumps have only to deal with non-condensable gases. Another type consists of an evacuated chamber containing a roller dryer.

- **Freeze Dryers**

The material is held on shelves or belts in a chamber that is under high vacuum In most cases, the food is frozen before being loaded into the dryer Heat is transferred to the

food by conduction or radiation and the vapor is removed by vacuum pump and then condensed.

3.4 Parameters in operation of driers

I. In drying:

- The latent heat of vaporization must be supplied and heat transferred to do this
- The moisture must be transported out from the food

II. Rates of drying depend on:

- vapor pressure of water at the drying temperature,
- vapor pressure of water in the external environment,
- equilibrium vapor pressure of water in the food,
- moisture content of the food

III. For most foods, drying proceeds initially at a constant rate

After a time the rate of drying decreases as the moisture content of the food reaches low values.

IV. Air is saturated with water vapor when the **partial pressure** of water vapor in the air equals the **saturation pressure** of water vapor at the same temperature.

V. Humidity of air is the ratio of the weight of water vapor to the weight of the dry air in the same volume.

VI. Relative humidity is the ratio of the actual to the saturation partial pressure of the water vapor at the air temperature.

VII. Water vapor/air humidity relationships are shown on the psychometric chart

3.5 Effects of Drying on Products

- Nutritional Degradation
- Reduction in Functionality
- loss of Structural Integrity
- Flavor and Aroma Changes
- Color Changes
- Leaching of Soluble Constituents

Self-check 3	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What is tunnel drier?(5 point)
2. List all the drying parameters? (3points)
3. What are the operating techniques of fluidized bed dryer? (2point)
4. Write effects of drying on Products? (2point)
5. Define drying process?

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

4.1 Maintain conditions

Process conditions important in making dried meats Creating safe dried meats relies on achieving the correct balance of several parameters during processing and storage. This concept of using two or more factors to control or inhibit microbial growth is called barrier technology. Using this concept, each hurdle can be applied at reduced levels to produce products that are safe and stable.

4.2. The factors that could be controlled are:

- temperature,
- time,
- water activity (moisture content),
- pH (a measure of acidity),
- preservative content,
- competitive microorganisms,
- Redox potential (a measure of the tendency to gain or lose electrons), and
- Irradiation.

4.3 Conditions used during marinating

The meat is generally held in a marinade for 18 to 24 hours, this storage is more likely to be at 4ºC. For jerky, strips of whole muscle are traditionally marinated for 12 to 24 hours.

4.4. Conditions used during the drying of the meat General Factors

The drying step is very important. **Water activity**, which is related to the moisture and salt content of the product, is an important parameter in achieving a safe product. The water activity of raw meat is around 0.98 and this is ideal for the growth of many microorganisms. Few pathogenic microorganisms grow below a water activity (aw) of 0.90 and few microorganisms grow below aw = 0.75. Yeasts and molds do not grow below a water activity of 0.60. Consequently achieving a low water activity in a short time is a main goal to create a safe product.

Effective drying, to reduce **water activity,** relies on drying time and three inter-related process factors: **air temperature**, **relative humidity**, and **speed**. The moisture content of a product during drying can be calculated from a set of equations. Solving these equations together requires a good mathematical knowledge; nonetheless, they can be used individually to explain why certain factors are important.

4.4.1 The rate of drying is expressed by the following equation:

Rate of drying = hm A (awps - pa)

Where hm = surface mass transfer coefficient. This factor depends on air speed.

Higher air speeds produce a higher mass transfer coefficient which leads to a higher rate of drying.

A = surface area of the meat. Thin strips have more surface area per unit weight than thick strips and will generally dry more quickly.

awps = water activity x saturated vapour pressure of the water at the surface temperature = vapour pressure of water at the meat surface

pa = vapor pressure of water in the air

The rate of drying will be high if the difference between awps and pa is large. On a humid day, pa is high and so the rate of drying is reduced. Similarly, as the product dries, the water activity (aw) is reduced and the rate of drying falls.

4.4.2. The rate of heating of the meat is described by:

Rate of heating = h A (Ta - Ts) - hm A (αps - pa) λ = heat exchange due to temperature difference - heat exchange due to the cooling effect of the water evaporating from the meat Using a high drying air temperature (Ta) causes a high rate of heating and high moisture loss from the meat surface: factors that would appear to be desirable.

However, a high heating rate may dry the surface of the meat but moisture inside the meat cannot move quickly enough to the surface for it to be removed. As a result, the surface dries and becomes hard but the inside of the meat remains moist: a condition known as "case-hardening".

Higher air temperatures, higher air speed, and lower relative humidity tend to lead to shorter drying times but care is required to avoid case hardening. If this occurs, then subsequent extended holding at lower ambient temperatures is required to allow the moisture to equilibrate.

4.4.3 Condition in moisture content

Reducing the moisture content of the meat is achieved by evaporation of water from peripheral zone of the meat to the surrounding air and the continuous migration of water from the deeper meat layer to the peripheral zone. Continuous evaporation and weight losses during drying cause changes in the shape of the meat through shrinkage of the muscle and connective tissue. The meat pieces become smaller, thinner and to some degree wrinkled. The consistency also changes from soft to firm to hard.

Meat with 4% added water and dried to around 28% moisture content would have a salt content of 11.1 % and would also be microbiologically stable. However, van der Vie notes that biltong at these low and high salt contents would not have acceptable taste. Biltong containing 6% salt and 24% moisture would be acceptable and would be typical of the products available at that time.

4.5 Factors Influencing Drying

- Product attributes
- Product size
- Product shape
- Composition and structure
- Moisture content
- Surface characteristics
- Specific surface area
- Specific heat capacity

4.5. Reasons for drying meat

A. Spoilage Reduction

The most important reason for drying food is to prevent or reduce spoilage and thereby create a product that remains edible for a longer period of time than it would in its un dried form. One of the most commonly observed spoilage microorganisms is “mold”. Similarly, microorganisms like Salmonella, Listeria, and E. coli can produce potentially

deadly toxins in foods if measures are not taken to properly process and preserve the food.

B. Enhanced Storage-Life

Water removal can increase the duration of time over which a food remains edible. While this is essentially the same as spoilage reduction, it is worthy of mention as a reason for drying a food product.

C. Changed Storage Conditions

All foods require certain conditions to prevent their spoilage. It is also desirable to preserve their taste, nutritional attributes, and other properties, such as aroma. In order to accomplish this, special storage conditions such as freezing or refrigeration may be necessary. If the food can be dried and stored at ambient or room temperature, it reduces the expense of maintaining specialized storage conditions. It also increases the potential market for a product when such storage and transportation conditions are not required.

D. Weight Reduction

In today's world, food production areas are often far from the areas where the food will be consumed. Much of the weight of many food products is attributable to the presence of water. If water can be removed, the weight can be reduced and the cost of shipping the product can also be reduced.

E. Increased Convenience

Many consumers want foods that are convenient. This is especially true in cases where there may not be enough time available to prepare a meal from fresh unprocessed products.

F. Changed Properties:

Dried foods may offer different properties from their un dried forms. These differences may create unique products that have applications which are quite novel compared to the original material. In addition, through drying, value may be added and new markets may be created to increase the use and commercial value of a particular raw material.

Self-check 4	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What are the factors that could be controlled in dry process of meat? (5 point)
2. What are Conditions used during marinating? (3points)
3. The equation of rate of drying is expressed by **…… .** ? (2point)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information sheet -5 Emptying drier

5.1Introduction

Emptying drier means unloading the dried meat product from the rolling rack or trays, perform cleaning operation on meat drier. Periodic cleaning and sanitation1, which includes disinfection of meat plant premises and equipment, is an integral part of Good Hygienic Practice (GHP), Cleaning and sanitation can even be considered as one of the most important activities in the meat plant, as these measures provide the necessary environment for proper meat handling and processing.

Efficient meat plant cleaning and sanitation is often neglected as it requires extra work and the positive effects are not immediately visible. However, failures in meat plant hygiene can cause high financial losses in the long run.

- Unhygienic conditions in a meat plant result in
  - ✓ unattractive, tasteless products
  - ✓ spoilage of valuable food and/or
  - ✓ food-borne diseases

Proper cleaning and sanitation is becoming increasingly important in modern meat processing as more perishable and hygienically sensitive meat products come on the market, particularly convenience foods such as pre packed portioned chilled meat, vacuum-packed sliced sausage and ham products, meat products in controlled atmosphere packages etc. The microbial load of such products must be low to guarantee adequate shelf life and to avoid spoilage during distribution.

5.2. How to carry out meat plant cleaning and sanitation

5.2.1. General

Preconditions for efficient cleaning and sanitation are:

- Premises and equipment must be “cleaning-friendly” which means - easy and practicable access to all contaminated areas, - smooth surfaces and adequate materials for building structures and equipment to be cleaned.
- Proven methods for meat plant cleaning and sanitation must be available.
- Personnel must be regularly instructed and trained in cleaning and sanitation methods.

a) The term “sanitation” usually refers to disinfection and pest control.

Cleaning is the removal of dirt and organic substances, such as fat and protein particles from surfaces of walls, floors, tools and equipment. Through the cleaning procedures, high numbers of microorganisms (90% and more) present on the mentioned objects will be removed. However, many microorganisms stick very firmly to surfaces, in particular in tiny almost invisible layers of organic materials, so called biofilms, and will not entirely be removed even by profound cleaning but persist and continue multiplying.

Inactivation of those microorganisms requires antimicrobial treatments, carried out in food industries through hot water or steam or through the application of disinfectants. Disinfectants are chemical substances, which kill microorganisms but should not affect human health through hazardous residues and not cause corrosion of equipment. The application of disinfectants is called disinfection. The term sanitation refers to the inactivation of microorganisms through disinfectants, but also includes combating pests such as insects and rodents through chemical substances (insecticides and rodenticides). When starting cleaning and disinfection/sanitation measures all food products must be removed from the area because:

- Physical cleaning with pressurized water may stir up dirt or produce contaminated water droplets (aerosol), which could contaminate meat present in such rooms.

- Chemical cleaning/disinfection may produce toxic residues when in contact with remaining meat or meat products. The same applies to insecticides and rodenticides for pest control.

Cleaning and disinfection procedures in the meat industries are complex processes depending on the surfaces to be treated and the kind of contamination to be removed. Selection of suitable chemicals for cleaning or for disinfection may require special knowledge. All these factors can make correct cleaning and disinfection a difficult task for the personnel involved. However, staff must be made aware that efficient cleaning and disinfection is of utmost importance for product quality and safety.

5.2.2 Cleaning techniques

The first step in floor and equipment cleaning is to physically remove scrap, i.e. coarse solid particles, with a dry brush or broom and shovel. This is usually referred to as “dry cleaning”. Using large amounts of water to remove this material would be extremely wasteful and eventually cause drains to clog and waste water treatment facilities to become overloaded.

More profound clean-up procedures require water in sufficient quantities. Manual cleaning using brushes or scrapers is widely applied in small scale operations although labor and time-intensive. A cleaning method commonly used in the meat industries is high pressure cleaning. The pressurized water is applied by high pressure units and special spraying lances.

The pressure should be between 30-70 bar and the spraying nozzle ≤15cm from the surface to be cleaned. Otherwise the pressure being applied decreases rapidly. If hot water is used, the temperature should be 55°C at the nozzle in order to achieve sufficiently high temperatures at the surfaces, in particular for fat removal.

Figure21 empting and cleaning meat drying machine

- **Alkaline cleaning agents**: Generally suitable for removing organic dirt, protein residues and fat.

- **Effect of detergents (surfactants):** Decrease of surface tension of water droplets and impact angle (below), dirt particles are easier loosened and removed from surface.

Figure 22: Foam cleaning

- **Acid cleaning agents:** Used particularly for removal of encrusted residues of dirt or protein or of inorganic deposits (“scaling”) such as water stone, milk stone, lime etc.

- **Neutral cleaning agents**: Have much less effect than alkaline or acid cleaning agents, but have mild impact on skin and materials and are useful for manual cleaning of smooth surfaces without encrusted dirt.

In practice alkaline and acid cleaning substances should be used alternatively. The alkaline agent should be the substance used for routine cleaning, but every few days an acid substance should be employed instead in order to remove encrusted residues, scaling etc. Cleaning substances together with the suspended dirt particles and fat must be rinsed off using potable water. A relatively new cleaning method for the food industry, in particular the larger-scale plants, is foam cleaning. Water foam containing detergents and other cleaning agents is sprayed on wetted walls, floors and surfaces of equipment. The foam does not immediately run off but clings to the surfaces. This

allows a longer term contact on the surfaces to be cleaned. After a sufficient impact period (min. 15 minutes) the foam is washed down with water (water hose or low-pressure water spray). As no high pressure water spraying is needed for washing off the foam, the spreading of water droplets (aerosol) in the room to be cleaned is minimized.

5.2.3 Disinfection techniques

Cleaning reduces a substantial amount of microorganisms but it does not have the potential to completely eliminate all surface contamination. Persistent microorganisms will continue to grow in number by using remaining protein as nutrients and pose a further risk to the foods to be processed.

The elimination of microorganisms is achieved through disinfection1), either by using hot water (or better steam) or chemical disinfectants. Chemical disinfectants are preferred for most applications in the meat industries as they are easy to use and do not involve the risk of accidents or other negative side effects such as damage to equipment by generating high humidity or water condensation, which may occur when using steam.

- Disinfectants for the meat industry

Disinfectants should be effective and rapidly acting in killing microorganisms. It should be noted that disinfectants do not sterilize the surfaces treated, absolute germ-free surfaces cannot be achieved, but disinfectants should kill all pathogens. The chemical composition of disinfectants varies depending on the specific target (slaughterhouse, meat processing, easily accessible open processing lines or closed food pipeline systems) and on chemical formulations by the individual disinfectant manufacturer.

Modern disinfectants are mostly mixtures of different chemical substances. Combinations of disinfection chemicals achieve a synergistic effect and result in the elimination of a broader spectrum of microorganisms. The exact compositions are sometimes not fully revealed by the manufacturers.

Table1 In principle the following groups of substances are used:

Disinfectants	Techniques
1. Chlorine containing compounds a) Na - or Ca-hypochlorite (Na/Ca O Cl) b) Gaseous chlorine (Cl2) (Hypochlorous acid is the effective substance used preferably for disinfection of water)	Effective against a wide range of bacteria, penetrates cell walls, but has a corroding effect on equipment
2. Aldehydes (used in animal production, e.g. Formaldedyde) Phenoles / Kresols (used in medicine, households Alcohols (used in medicine, e.g. skin) Alkalines (pH 10 or higher) (e.g. NaOH, used in animal production) Acids (some organic acids used in food industries)	Destruction of microorganisms, may be corrosive
3. Quaternary ammonium compounds (QUATS) Amphotensids (used in food industries, as not corrosive) Low efficiency on spores	Effect on cell walls, not corrosive, odourless, additional cleaning properties (surfactant)
4. Oxygen releasing substances Peroxide compounds (H2O2) Per-acetic acid (use in food industries)	Penetrate into cells, good effect on all microorganisms incl. spores and virus, odourless, may be corrosive in concentrations >1%

5.2.4. Cleaning and disinfection (sanitation) schemes

Meat industry staff must be made fully aware of the need for proper cleaning. Cleaning should be treated as an integral part of the production process. It should be done carefully and not just superficially or in a rush at the end of the production process.

While daily cleaning or even cleaning several times a day is an absolute necessity, it has to be decided according to type and product lines or activity of each individual meat plant, where and at which time intervals disinfection measures should be applied.

Frequency of disinfection depends on need requirements:

- Several daily disinfections (by hot water or chemicals) are necessary for hand tools, meat saws and cutting boards.
- Daily disinfection is useful for dismantled equipment such as parts of grinders, fillers, stuffers, etc.
- Disinfection once a week is recommended for other equipment and floors and walls of processing and chilling rooms.

5.2.5. Cleaning and disinfection plans

For all rooms and all equipment used for meat processing or meat storage, specific cleaning and disinfection plans should be established.

In table 2, an example is given for disinfection of meat processing equipment, in this case for a meat grinder. This type of equipment is an integral part of almost every meat processing line. Meat grinders require particular careful and frequent cleaning and sanitation, as the output product minced meat is hygienically very sensitive.

Equipment: Meat grinder

Pre-cleaning	Potable water Temp.: 40-50°C Pressure: 20-30 bars	
Cleaning	Daily Agent: A Concenter: 1.0% Temp.: 40-50°C Time: 20-30 min pH: approx. 12	1 x monthly Agent: B concenter.: 1.5% Temp.: 40-50°C Time: 20-30 min pH: approx. 1.8
Rinsing	Potable water Temp.: 30-50°C Pressure: 5-10 bars	

Equipment: Drying

Disinfection	**G.** x weekly Agent: C Concentr.: 0.5% Temp.: 30-40°C Time: 30 min pH: approx. 5.7	**H.** x weekly Agent: D Concentr.: 1.0% Temp.: 30-40°C Time: 30 min pH: approx. 10.2
Rinsing	Potable water Temp.: 30-50°C Pressure: 5-10 bars	

Agent A: Alkaline cleaning substance

Agent B: Acid cleaning substance

Agent C: Disinfectant

Agent D: Disinfectant chemically different from C and supplementing impact of C

Self-check 2	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What is emptying drier mean? (2 point)
2. Explain Cleaning and disinfection plans? (3points)
3. Explain cleaning techniques of meat plants.(3point)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

operation sheet 1	Operating drying for dried beef jerky

Operating drying for dried beef jerky (dried meat product of beef lean meat)

Step 1 Slice the selected meat no thicker than ¼ inch. Partially freeze meat to make slicing easier.

The thickness of the meat strips affects the safety of the methods recommended.

Step2 .load of the sliced meat into rotating dram and

Step 3. Add of dry & liquid ingredients and

Step4. Mix together

The ingredients to marinate is: salt, spice, acid ingredients such as vinegar, lemon juice, teriyaki, soy sauce or wine.

Step 5.Marinate for 24hour, Marinating is used to tenderize and flavor the jerky before dehydrating it.

Step 6. Unload the marinated meat strips from the rotating dam

step8. Place the meat strips in stainless steel metal rode at all untill the meat strips end.

Step9. Fill the entire metal rod by meat strips hug the rode in rolling rack

Step10.Hang it into the rolling rack and send to drier machinery that has circulated warm air, and adjust the drier in 82^{o}c for 3-5hour

Step11. Enter the jerky into automated weight scale machine &
Cut all dried meat to 3- 5cm by cutter suitable for package.

Step12. Measure the thickness of the single dried meat strips taken from fully dried meat batches through 5minutes continuously.

Step13. Transfer dried meat to into filling line.

Step14. Perform filling and process

Step15. Pack the product

Step16. Transport the dried meat product (jerky) package into boxing area.

LAP Test	Moisture content determination

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Use personnel protective equipment,

Given necessary templates tools and materials you are required to perform the following tasks within 1 hours.

Task1. Perform Processing dried meat product (jerky) by using the meat drier

LG 59	LO 3- inspecting and store dried meat

Instruction sheet

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

- Inspecting dried product
- Storing dried product prior to packing

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

- Inspect dried product
- Store dried product prior to packing

Learning Instructions:

1. Read the specific objectives of this Learning Guide
2. Follow the instructions described below
3. Read the information written in the “Information Sheets” Try to understand what are being discussed Ask your trainer for assistance if you have hard time understanding them
4. Accomplish the “Self-checks” which are placed following all information sheets
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work (You are to get the key answer only after you finished answering the Self-checks)
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, ask your trainer for further instructions or go back to “Operation sheets”

1.1 simple test methods for meat products

- sensory evaluation
- physical
- chemical and
- Microbiological testing

1.1.1 Sensory evaluation

Sensory evaluation is a common and very useful tool in quality assessment of processed meat products. It makes use of the senses to evaluate the general acceptability and quality attributes of the products.

- **Sense of sight** is used to evaluate the general appearance of the product such as color, size, shape etc.
- **Sense of smell** for the odor
- **Sense of taste** for the flavor which includes the four basic tastes sour, sweet, bitter and salty
- **Sense of touch** for the texture either by mouth feel or finger feel

1.1.2 Physical test methods in meat processing

With physical test methods important parameters such as temperature, acidity (pH), water activity (aw) and water binding capacity can be determined. Other physical parameters are light intensity and mechanical testing for texture. All routine physical testing can be carried out with portable instruments.

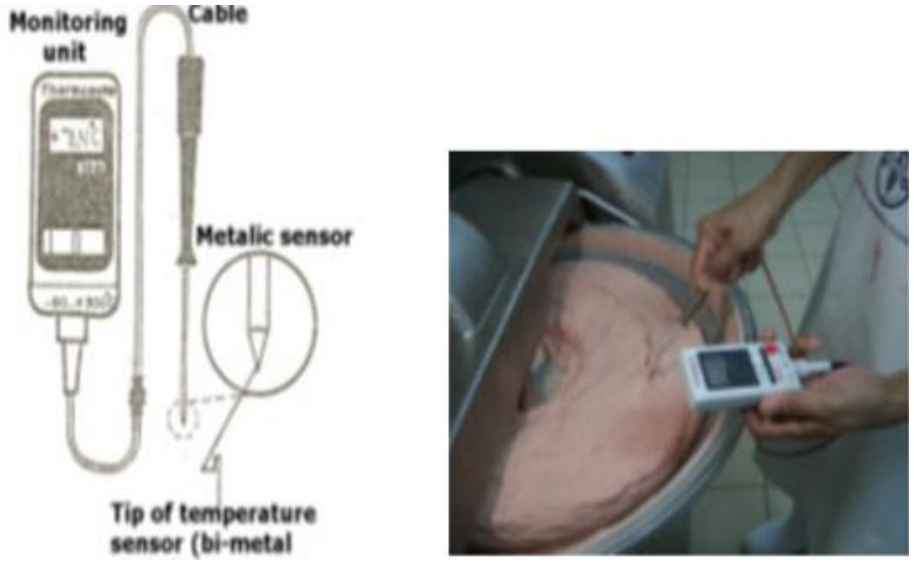

Figure 24 Electronic thermometer & Measurement of temperature of meat batter

- Important temperature control points are:
  - ✓ Refrigerated rooms (freezer -18°C to -30°C, chiller 0 to +7°C)
  - ✓ Chilled meat (+4 to +7°C)
  - ✓ Cutting rooms (+10 to +15°C)
  - ✓ Curing rooms (+5 to +10°C)
  - ✓ Water temperature in cooking vats (+75 to +78°C)
  - ✓ Core temperature in meat products upon cooking/pasteurization
  - ✓ (approx. +68/72°C)
  - ✓ Core temperature in meat products during sterilization1 (above +100°C)
  - ✓ Sterilization temperature in autoclaves (above +100°C)1

1.1.3. PH meters

Portable instruments are battery driven and have glass electrodes. The pH–value in meat and meat products can be measured by direct contact between the sensitive diaphragm of the electrode and the meat tissue. The pH is a measure of the acidity or alkalinity in solutions or water containing substances. pH values lower than 7 are considered acidic, while pH values higher than 7 are considered alkaline. A pH of 7 indicates neutrality. pH values are related to the concentration of hydrogen ions (H+) in the substance.

Figure25. PH meter & pH meter. Inserting glass electrode in meat tissue

- pH measurement is useful for:
  - ✓ Evaluation of meat quality for further processing, in particular
  - ✓ the water binding capacity
  - ✓ Control of ripening of raw fermented products, which is connected
  - ✓ with drop in pH
  - ✓ Control of acidity of ingredients such as brines, marinades etc.

Typical pH values for meat and meat products are:

Products	pH value (range)
Meat mixes in jelly + vinegar added	4.5 to 5.2
Raw fermented sausage	4.8 to 6.0
Beef	5.4 to 6.0
Pork	5.5 to 6.2
Canned meats	5.8 to 6.2
Curing brines	6.2 to 6.4
Blood sausages	6.5 to 6.8
Muscle tissues, immediately after slaughter	7.0 to 7.2
Blood	7.3 to 7.6

1.1.4. AW - meter (mechanical instrument)

Water activity1 is the term for the amount of free (not chemically or physically bound) water, which is available for the growth of microorganisms. This information is particularly important, as higher amounts of free water favour the growth of microorganisms, while lower amounts (drier products) result in less microbial growth. Bacteria usually require at least aw 0.91 and fungi at least aw 0.71.

Areas for aw-control:

- Measurement of aw is important during the ripening of dry fermented products to find out at which point the products remain stable at ambient temperature.
- The aw plays a major role in meat preservation for dried products (dried meat, meat floss etc.), or for products where the microbiological stability is achieved through several factors, e.g. low aw, low ph, and/or heat treatment

Figure-26 Aw-meter with product sample to be tested, lid (has to be attached) with built-in hygrometer

- Sensory testing (chewing) is normally sufficient to test tenderness/toughness or homogenous/fibrous structure of meat and meat products.

Figure 27 Instrument for texture measurement

1.2. Simple methods of chemical analysis (Protein, fat, water, ashes)

Chemical analyses to determine the content of protein, fat, water and minerals (ashes) of processed meat products (see also table 1) are carried out to establish the nutritive and economic value of the products. Samples of the meat product are finely ground and weighed accurately for each respective chemical analysis.

The determination of the **moisture content** (or water content) is done by drying an appropriate amount of the sample. The difference in weight between the fresh and dried samples represents the water content.

Figure 28 Microwave oven (for water)

The **protein content** is determined at laboratory level by using the Kjeldahl method. Where meat products are digested by acid to obtain the nitrogen compounds and then distilled and titrated to determine nitrogen quantitatively, with which the protein component can be calculated.

1.3. Protein content determination:

Calculation of the approximate protein content for pure meat and meat products:

% Protein = 100% - (%water + % ash + % fat)

This calculation is not applicable for meat products that were extended.

Figure 29 Kjeldahl distilling apparatus (for protein)

Determination of the fat content is the most complicated component of simple meat and meat product analysis, as analytical equipment. Samples for fat analysis are semi-dried before being subjected to ether-extraction using the Soxhlet apparatus. After complete extraction, the fat is obtained by evaporating and recovering the ether.

Figure 7 Soxhlet extraction apparatus (for fat)

Figure8 Muffle furnaces (for minerals)

1..4 Microbiological sampling and testing

The purpose of microbiological testing is to **determine the degree of bacterial contamination** on surfaces of equipment, tools, premises as well as in meat and meat products. This testing can be done **qualitatively** as microbiological screening, for example by contact such as using an impression plate or **quantitatively** by determining the exact number of microorganism per sample unit (in cm2 or grams) by using the swab or the destructive method. Quantitative testing can be either determination of the entire contaminating flora, also called “total plate count” or determination of a specific group of microorganisms out of the entire flora, also called “selective plate count”.

1.5 Quality of the finished product

Drying of fresh untreated meat of the shape described (strips or flat) takes at least two days, in many cases three to four days After this period the dried meat is ready for consumption and can be packaged, stored and/or transported

At this stage the product should meet the following quality criteria:

- The appearance of the dried meat should be as uniform as possible
- The absence of large wrinkles and notches indicates the desired steady and uniform dehydration of meat

The **colour** of the surface, as well as of the cross-cut should be uniform and dark red A darker peripheral layer and bright red colour in the centre indicates excessively fast drying Because of the remaining higher water content in the centre, these meat parts may still be susceptible to microbiological growth

The **texture** of properly dried meat must be hard, similar to frozen meat. A softer texture can be recognized by pressing the meat between your fingers These pieces should be kept for one more day in the dryer for finishing .

Taste and flavor are very important criteria for the acceptance of dried meat by the consumer Dried meat should possess a mild salty taste which is characteristic for naturally dried meat with no added spices

Off-odors must not occur however, a slightly rancid flavor, which occurs because of chemical changes during drying and storage, is commonly found in dried meat and is acceptable. Dried meat with a high fat content should not be stored for a long period but used as soon as possible in order to avoid intensive rancidity.

Self-check 2	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. What are simple test methods for meat products? (3 point)
2. Why pH measurement is useful for? (2point)
3. What is Sensory evaluation of dried meat product? (3points)
4. Write all Important temperature control points (2point)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

2.1 Food Storage

Food storage should be in appropriate temperature control units (walk-in coolers, refrigerators or freezers) capable of maintaining proper product temperatures. All potentially hazardous foods (PHF) should be maintained at 41°F (5°C) or less and it is recommended that frozen items be stored at 0°F (-18°C) or less The foods may include raw ingredients or finished products

These types of foods may be stored in separate units or segregated with adequate protection to prevent cross-contamination within the same unit Display counters are not considered storage units and should not be used to store raw ingredients or finished products prior to actual display The storage temperatures should be monitored as part of the daily SOP's. The storage unit(s) is clean and orderly Products are contained and/or covered for protection.

2.2 Changes in Quality during Storage of Dried Meat

Biochemical, physicochemical, and microbiological changes may occur during storage of dried meat, the extent of which depends on aw, pH, type of packaging, and storage air conditions (temperature and relative humidity). These alterations are mainly due to the activity of microorganisms surviving at low aw, along with some enzymatic and chemical reactions like browning or oxidation Although most dried meats are shelf-stable with regard to food safety (due to lower aw, pH), a proper packaging system is important for chemical and microbial shelf stability.

Chemical deterioration in dried meats most often refers to lipid oxidation is usually started by the action of a catalyst: heat, light, or oxygen. Many different compounds form during oxidation, imparting a rancid flavor and odor in meat. However, microbial deterioration is usually due to mold growth on the surface. Different packaging may be used to improve storage conditions.

- Generally, the products are packaged under vacuum or modified atmosphere Vacuum packaging of dried meats removes oxygen, thus reducing rancidity. Packaging also prevents potential mold growth (that can lead to a rise in the pH, which may then allow growth of pathogens) .
- Containers of products or ingredients that are removed from the original (identified) packages are relabeled, marked for identification and dated.
- Ready-to-eat items and items ready-for-display are segregated from products that require further handling or processing. Products are not stacked without adequate support and means to prevent any leakage between products. Drip page is prevented in or on packaged products due to condensation, cooler pan leaks or other wet sources
- Products are stored above the floor and away from walls and the ceiling.
- The schedule for product rotation should use a 'First-in First-out' rule (FIFO)
- Display units are not considered storage units and should not be used to store raw ingredients. Display units must be maintained at or below 41°F (5°C)
- Frozen storage unit(s) have the capacity and are operating correctly to assure the frozen foods are maintained solidly frozen, preferably at /or below 0oF (-18°C)
- Routine monitoring for proper refrigerated storage unit temperatures involves use of a continuous time-temperature recording device or by periodic checks with a thermometer
- All recorders and thermometers are calibrated periodically or as needed. When storage conditions above 41°F (5°C) are detected, an evaluation is conducted of all products stored in the unit.
- The evaluations will document considerations for the actual temperature of the products and duration of exposure.
- All temperature abused, off-color, off-odor, off-condition, out-of-date or otherwise suspect product is discarded
- **Frozen products** are thawed in refrigeration (below 41°F / 5°C) in a manner to prevent cross-contamination with other refrigerated foods If more rapid thawing is necessary, the products are placed in clean flowing water no warmer than

70°F (21°C) only until thawing is complete Product does not have to reach 70°F to be thawed

- Do not allow products to melt beyond 41°F (5°C) continuing processing or return to proper refrigeration Packaging is recommended to protect the product from direct contact with the liquefy water. If thawing requires direct water contact with the food, the procedure should be conducted in a sanitized sink or container that is designated or dedicated to this operation. Thawing is not conducted in water warmer than 70°F or at room temperature

Self-check 2	Written test

Name…… ID…… Date……

Directions: Answer all the questions listed below Examples may be necessary to aid some explanations/answers

Test I: Short Answer Questions

1. Explain Biochemical, physicochemical, and microbiological changes occur in storage (2 point).
2. Define chemical deterioration in dried meat? (3points)
3. Define routine monitoring refrigerator(2 point)

You can ask you teacher for the copy of the correct answers

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Operation sheet 1	Moisture analysis and method

Sampling of Meat and Meat Products

A. Sampling and analytical procedures

Step I. Grind the cold meat sample, minimum weight 500 gms. Use food grinder with 3mm plate opening.

Step II. Mix rapidly at a cold temperature.

Step III. Keep ground sample in glass or similar containers which are air and liquid tight.

Step IV. Ready for analysis. If any delay occurs, chill the sample to inhibit decomposition.

Step V. Weigh the sample as rapidly as possible to minimize loss of moisture.

B. Moisture Analysis (Microwave Drying)

General:

Samples are dried in a microwave oven and the loss of weight upon drying is expressed as percent moisture content.

Application:

This method may be used to determine the moisture content of fresh meat, Semi-processed meat, meat mixes and processed meat products.

Equipment:

- Mincer with 6mm plates or heavy duty food processor.
- Balance with at least 0.1g sensitivity.
- Microwave oven with 600-700 watt microwave energy output, turntable and time accurate to 15 seconds.
- Desiccators with silica gel.
- Beaker
- Filter papers, 7cm diameter or open weave disposable kitchen cloth.
- Silicon carbide (carborandum) finely ground.
- Sand or salt.

Table 1 Approximate Drying Times for Sample Sizes of Meat

Sample size Approximate	Drying Time
3 x10g	3.5 -4.5 min
3 x25g	7.5 -9.5 min
2 x 50g	8.5 -11 min

Calculation:

Weight of beaker plus filter paper = A

Weight of beaker plus filter paper + sample = B (before drying) in grams

Weight of beaker plus filter paper + sample = C (after drying) in grams

$$\% \text{ Moisture} = \frac{(B-C)}{(B-A) = (\text{weight of sample})} \times 100$$

Method

I. Prepare the sample by mincing or chopping as described in sample preparation.

II. Preheat the oven

III. Dry the beakers and filter papers by heating them in a microwave oven for one minute.

IV. Determine the heating time necessary to completely dry the samples in the microwave oven.

V. Weigh an empty beaker plus filter paper. Weigh about 10 grams of sample in the beaker. For meat samples, spread the samples into a thin layer around the lower wall of the container with spatula or spoon. Place the filter paper over the top of the beaker and fold to close and accurately weigh the beaker plus filter paper.

VI. Place the samples in the preheated oven. The samples should be spaced at equal distances around the turntable.

VII. Cool the samples in a desiccator and accurately weigh the beaker plus dried samples plus filter paper.

VIII. 8. Repeat drying until constant weight is obtained.

Operation sheet 3	Cure fat determination

I) Crude fat determination using samples dried from the microwave oven:

Method

- Get the weight of the dried sample.
- Put the dried sample inside the filter paper and fold to close.
- Place the dried sample inside the soxhlet extraction tube connected to the soxhlet flask.
- Pour enough ether into the extraction tube.
- Extract for 10 hours, at 3-4 drops per second.
- After extraction, take out the defatted sample from the extraction tube and air dry the sample for traces of ether. Dry further in an oven at 100°C and cool in a dessicator. Weigh the defatted cooled samples to constant weight.

Computation:

$$\% \text{ Fat} = \frac{\text{Weight of Dried Sample} - \text{Weight of Defatted sample}}{\text{Original weight of the sample}} \times 100$$

Weight of dried sample = (weight of beaker + filter paper + dried sample) - (weight of beaker + filter paper)

II. Ash determination:

- The defatted sample is placed in a constant weight porcelain crucible with cover.
- The crucible is then placed in a muffle furnace, and at a temperature of
- 600°C the sample is ignited for two hours.
- After ignition the crucible is placed in the oven to bring down the temperature
- for about 30 minutes, then cool in a dessicator for another 30 minutes.
- The sample is then weighed to constant weight.

Computation:

$$\% \text{ Ash} = \frac{(\text{Wt. of crucible with cover + ash}) - \text{wt. of crucible with cover}}{\text{Original weight of sample}} \times 100$$

LAP Test	Moisture content determination

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Use personnel protective equipment,

Given necessary templates tools and materials you are required to perform the following tasks within 1 hours.

Task1. Perform sample analysis

Task2. Determine of moisture content%.

Task3. Determine crude fat

Task4 Determine Ash content

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Answers

Learning guide 1

Self-check 1

1. Flat and street shape
2. Trimming the meat to remove the connective tissue and visible fat
3. Due to the low water content, microbial spoilage of the muscle proteins can be safely prevented
4. Meat drying is a simple but efficient food preservation activity

Self-check 2

1. Inspection
    - Removal of completely abnormal products from the meat chain;
    - Prevention of the distribution of infected meat that could give rise to disease in humans; and
    - Assistance in the detection and eradication of certain diseases of livestock
2. Meat inspection is designed to determine the health of animals both prior to death (ante mortem)
   and after death (post mortem).
3. (b1) GRADE Beef 1 Lean muscle meat with all visible fat and connective tissue removed
   (b2) GRADE Beef 2(B2) Muscle meat trimmings with small quantities of connective tissue (<10%) and body fats (<10%)
   (b3) GRADE Beef 3(B3) Muscle meat trimmings with connective tissue (<20%) and body fats (<20%)

self- check 3

1. the protein portion –results the production of unpleasant putrefactive odors
   the carbohydrate components – causing intensive sour taste or acidty
   the fat portion - producing rancidity
2.
   - **Reject** incoming meat with too high internal temperatures
   - **Adjust** cooking and sterilization parameters (temperature/time)
   - **Reject** meat with too high pH
   - **Adjust** quantity of curing substances

3. **Physical hazards**: Rests of unwanted materials (glass, bone fragments, animal teeth, metal fragments, broken knife blades, needles, plastics, stones)

   Biological hazards:
   - Parasites
   - bacteria
   - molds
   - viruses

   Chemical hazards:
   - Contaminants
   - Residues
   - Food additives with risk of overdoses

4.
   - Hazard analysis and risk assessment
   - Identification of Critical Control Points (CCP)
   - Establishment of Critical Limits for each CCP
   - Establishment of a monitoring system for each CCP
   - Establishment of corrective actions
   - Establishment of verification procedures
   - Establishment of documents and records

5.

- **Meat spoilage**

✓ Putrefaction- breakdown of protein example slime

✓ Sourness- production of lactic acid example- discoloration

✓ Rancidity (breakdown of fats)

- **Meat poisoning**

✓ Infection (ingested with contaminated meat, bacteria multiply and procedure toxins in consumer's organism, cause illness)

✓ Intoxication (microorganism-bacteria mold-multiply in contaminated meat and produce toxins, ingestion by consumer, causes illness.

Self-check 4

1. a
2. a
3. a
4. **a**

Self-check 1

1.

- Remove all finished products to the designated storage areas.
- Remove or cover any packaging material.
- Clean up any debris on the floor.
- Follow proper lock out procedure before equipment is disassembled, as necessary.
- Food debris is removed from equipment. Remove all garbage from the production area.

2.

- Debris is swept up and discarded.
- Facilities are rinsed with potable water.
- Facilities are cleaned with approved detergent (Personal Protective Equipment is used when cleaning).
- Rinse
- Sanitize as required

3.

B. General Equipment Cleaning
C. Cleaning of facilities, including floors, walls and ceilings
D. Food processing Operations cleaning

Self-check 2

1. Loading of meat is the process of putting the slice marinated meat in plate or trays.
   Putting of marinated meat is important process in drying.
2. When the marinated meat is ready to dry, that is stored for 24hour in storage.
3.

- should be constructed from stain less steel metal that can prevent corrosion and also
- it should be suitable for handling to move it easily on processing area.
- It should be wash or clean every day after processing of drying batch

Self-check 3

1. Tunnel dryer

These may be regarded as developments of the tray dryer, in which the trays on trolleys move through a tunnel where the heat is applied and the vapors removed In most cases, air is used in tunnel drying and the material can move through the dryer either parallel or counter current to the air flow Sometimes the dryers are compartmented, and cross-flow may also be used.

2.

1. In drying:
2. Rates of drying depend on:
3. For most foods, drying proceeds initially at a constant rate
   After a time the rate of drying decreases as the moisture content
   of the food reaches low values.
4. Air is saturated with water vapor when the **partial pressure** of water vapor in the air equals the **saturation pressure** of water vapor at the same temperature.
5. Humidity of air is the ratio of the weight of water vapor to the weight of the dry air in the same volume.
6. Relative humidity is the ratio of the actual to the saturation partial pressure of the water vapor at the air temperature.
7. Water vapor/air humidity relationships are shown on the psychometric chart

3.

- **Fluidized Bed Dryers\hot air steam**

In a fluidized bed dryer, the food material is maintained suspended against gravity in an upward-flowing air stream. There may also be a horizontal air flow helping to convey the food through the dryer Heat is transferred from the air to the food material, mostly by convection.

4.

Effects of Drying on Products

- Nutritional Degradation
- Reduction in Functionality
- loss of Structural Integrity
- Flavor and Aroma Changes
- Color Changes
- Leaching of Soluble Constituents

5. **Drying of meat** implies the removal of water from the food. In most cases, drying is accomplished by vaporizing the water that is contained in the food, and to do this the latent heat of vaporization must be supplied.

Self-check4

1.

- temperature,
- time,
- water activity (moisture content),
- pH (a measure of acidity),
- preservative content,
- competitive microorganisms,
- Redox potential (a measure of the tendency to gain or lose electrons), and
- Irradiation

2. Conditions used during marinating

The meat is generally held in a marinade for 18 to 24 hours, this storage is more likely to be at 4ºC. For jerky, strips of whole muscle are traditionally marinated for 12 to 24 hours.

3. The rate of drying is expressed by the following equation:

Rate of drying = hm A (awps - pa)

Self- check 4

1. Emptying drier means unloading the dried meat product from the rolling rack or trays, perform cleaning operation on meat drier.
2. Disinfection technique

   The elimination of microorganisms is achieved through disinfection1), either by using hot water (or better steam) or chemical disinfectants. Chemical disinfectants are preferred for most applications in the meat industries as they are easy to use and do not involve the risk of accidents or other negative side effects such as damage to equipment by generating high humidity or water condensation, which may occur when using steam.

   3. meat mincer and dryer

Pre-cleaning
Cleaning
Rinsing
Disinfection
Rinsing

Learning guide 3

Self- check 1

1. **simple test methods for meat products**
   - sensory evaluation
   - physical
   - chemical and
   - Microbiological testing
2. pH measurement is useful for:
   - ✓ Evaluation of meat quality for further processing, in particular
   - ✓ the water binding capacity
   - ✓ Control of ripening of raw fermented products, which is connected
   - ✓ with drop in pH
   - ✓ Control of acidity of ingredients such as brines, marinades etc.
3. sensory evaluation
   - ✓ **Sense of sight** is used to evaluate the general appearance of the product such as color, size, shape etc.
   - ✓ **Sense of smell** for the odor
   - ✓ **Sense of taste** for the flavor which includes the four basic tastes sour, sweet, bitter and salty
   - ✓ **Sense of touch** for the texture either by mouth feel or finger feel

4. Important temperature control points are:
   - ✓ Refrigerated rooms (freezer -18°C to -30°C, chiller 0 to +7°C)
   - ✓ Chilled meat (+4 to +7°C)
   - ✓ Cutting rooms (+10 to +15°C)
   - ✓ Curing rooms (+5 to +10°C)
   - ✓ Water temperature in cooking vats (+75 to +78°C)
   - ✓ Core temperature in meat products upon cooking/pasteurization
   - ✓ (approx. +68/72°C)
   - ✓ Core temperature in meat products during sterilization1 (above +100°C)
   - ✓ Sterilization temperature in autoclaves (above +100°C)1

Self – check 2

1. **Biochemical, physicochemical, and microbiological** changes may occur during storage of dried meat, the extent of which depends on aw, pH, type of packaging, and storage air conditions (temperature and relative humidity).
2. **Chemical deterioration** in dried meats most often refers to lipid oxidation is usually started by the action of a catalyst: heat, light, or oxygen. Many different compounds form during oxidation, imparting a rancid flavor and odor in meat.
3. Routine monitoring for proper refrigerated storage unit temperatures involves use of a continuous time-temperature recording device or by periodic checks with a thermometer