TVET CERTIFICATE V IN FOOD PROCESSING

SAUSAGE MAKING

FOPSM401

Make sausage

Competence

Credits: 8

Learning hours: 80

Sector: Agriculture and Food Processing

Sub-sector: Food Processing

Module Note Issue date: August, 2020

Purpose statement

Sausage making is a food processing sub-sector that focuses on adding value to meat. It is gaining importance in Rwanda in terms of income generation for meat processors. The competence of making sausage is for learners who have successfully completed the certificate III. The learner will be equipped with skills in making dried, smoked and cooked sausages. At the end of the module, the learner will be able to prepare work area and equipment, and process meat into dried, smoked and cooked sausage. The learners will be able to work in sausage processing units, supermarkets that have meat processing section and other meat processing plants with high level of efficiency and effectiveness under minimum supervision.

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INTRODUCTION

Sausage is a meat product made of finely chopped and seasoned meat, which may be fresh, smoked, or pickled and which is then usually stuffed into a casing. Sausages of fish or poultry are also made. The word sausage, from the Latin *salsus* ("salted"), refers to a food-processing method that had been used for centuries

Fig. Sausages

Casings

Traditionally, sausage casings were made of the cleaned intestines, or stomachs in the case of haggis and other traditional puddings. Today, however, natural casings are often replaced by collagen, cellulose, or even plastic casings, especially in the case of industrially manufactured sausages. Some forms of sausage, such as sliced sausage, are prepared without a casing.

Processing method

Sausage-processing methods include cooking, curing (by application of salt solution), and smoking (exposure to smoke, often following curing). The last two methods, originally employed for preservation, are now used mainly for their contribution to flavor.

Types of sausages

According to the processing method employed, sausages are classified as fresh (not cooked or cured); uncooked smoked; cooked smoked; cooked fresh and cooked dried.

Fig. Fresh cooked sausages

Fig. Cooked sausage

Fig. Smoked sausage

Fig. Dried sausages

Learning Unit 1: Prepare the work area for sausage processing

LO 1.1 Describe the work area for sausage processing

- **Topic 1:** Processing flowchart of sausage processing

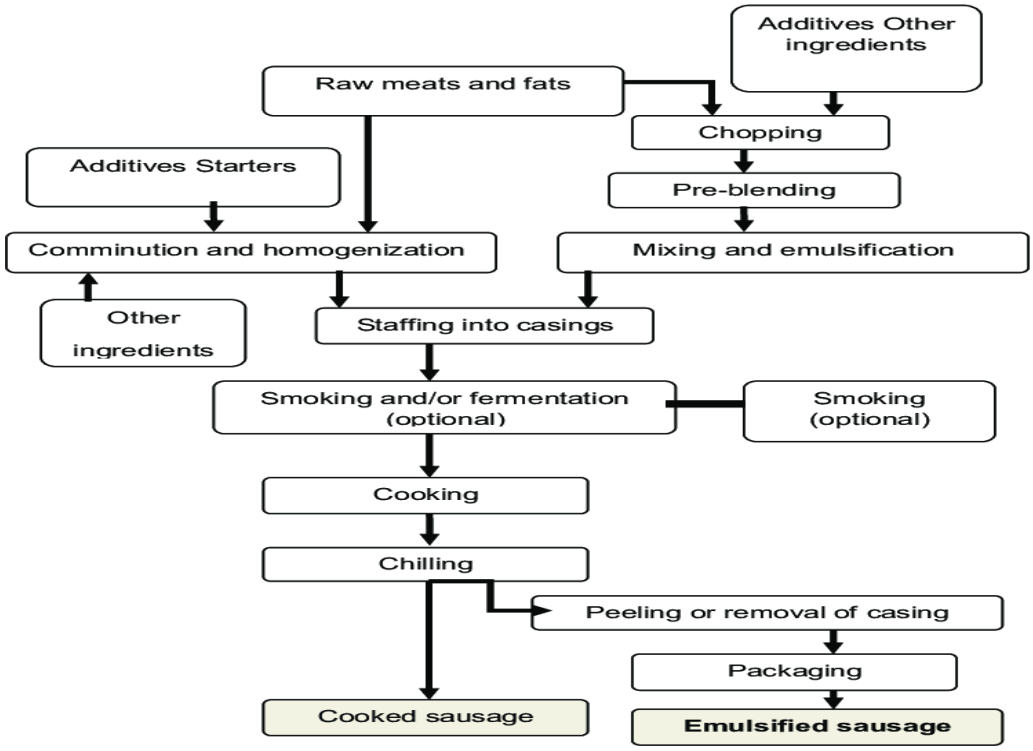


Fig. Processing flowchart of sausage processing

- **Grinding**: meat chunks of variable size and shape and with variable fat contents are ground to uniform cylinders of fat and lean.
- **Mixing**: cylinders of fat and lean obtained by grinding are tumbled in a mixer to give a uniform distribution of fat and lean particles, and with addition of required ingredients to obtain the desired texture and uniformity of composition.
- **Chopping:** a chopper is often used as a means of batching the sausage mix. The mixed patch being transferred to an emulsifier for acquiring the desired texture.
- **Emulsifying**: it has the principles of grinding and chopping. Emulsifiers handle large volumes of meat rapidly to produce desired texture.

- **Stuffing:** the sausage emulsion (mix, sausage dough or batter) it is transferred to stuffers for extruding into casings. At this point the size and shape of the product is determined.
- **Linking and tying:** after the emulsion is stuffed into casings, the encased mass is tied with thread or fastened with metal clips or mechanical device.
- **Smoking:** Optional depending on the type of sausage
- **Fermentation:** Optional depending on the type of sausage
- **Cooking**
- **Chilling**: after smoking and cooking the product is showered with cold water and chilled by refrigeration.
- Peeling and packaging: after proper chilling the product usually to an internal temperature of 35-40 F. the cellulosic casings on frankfurters are removed. This known as peeling operation and packaged.

- **Topic 2**: Sausage plant layout

While sausage plant layouts vary widely according to the diversity and volume of products, certain well-defined principles are always respected in present-day plants. Anywhere where space permits, product movement should follow a straight line pattern, from the receipt of raw material and its storage through trimming, mincing, emulsifying, filling, smoking and cooking operations to the packaging, storage and distribution of the finished product. The main technological and hygienic principles in developing sausage plant layout are the maximum speed in handling raw materials and products and the shortest time intervals between operations resulting in the shortest possible distances consistent with the size and type of the plant.

There are some common requirements determining the layout of a sausage plant. Doubtlessly, the basic requirement is that the raw materials should enter at one end of the building and the sausage products, either chilled or unchilled, leave at the opposite end. The arrangement should be that the meat and products move in one direction without any risk of contamination. The operators are placed along the tables and machines and they move the raw materials and sausages in the necessary direction.

Normally, a sausage plant begins with a receiving and chilling section. When the meats reach the plant by truck, provision has to be made for an offloading ramp. There should be a direct

and unobstructed entrance from the receiving area to the chill room and main processing room. The operation of receipt, weighing and storage of meats should be carried out in a refrigerated room adjacent to the main workroom. Where output permits, nonmeat raw materials (casings, spices, packaging materials etc.) should be dealt with separately in order to ensure a good hygienic standard.

Effort should be made to provide refrigeration in the cutting and trimming room. The deboning and trimming operations should be performed on special tables in a clean and controlled atmosphere. The deboning of hot carcasses should have priority.

All grinding, chopping, stuffing, linking and other processing operations have to be organized in a separate room. The type and extent of equipment required for comminuting meat and stuffing sausages depend upon the variety and volume of the operations. For operations of any magnitude, equipment such as an ice crusher or ice generator, knife grinder, frozen meat slicer etc. is advisable.

The meat, after being trimmed, graded, chopped and mixed with nonmeat ingredients, is conveyed from the cutter to the stuffer for filling into casings and then the sausages, hung on smoke rods, are carried from the meat chopping and mixing area to the smoking and cooking facilities. Any sausage manufacturing line terminates in the smokehouse and cooker, where the necessary trucks, cages and other accessories are available. The size of the smokehouse and boiler will depend upon the factory throughput. Adequate provisions should be made even in the smallest plant for weighing, grading, storing and distribution of final products.

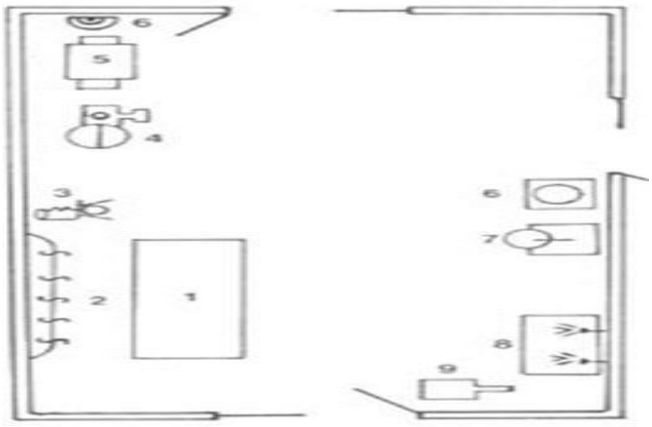


Fig. Sausage plant layout

Cutting and trimming area:
1 - working table, 2 - overhead rail:

Chopping and mixing area:
3 - mixer, 4 - grinder and cutter,
5 - vacuum mixer, 6 - steam sterilizer,
7 - colloid mill, 8 - washing vat.

In such a way, a sausage plant is composed of the following areas or section: (a) receiving and chilling, (b) cutting and trimming, (c) nonmeat ingredients, (d) meat chopping and mixing, (e) smoking and cooking and (f) wrapping and dispatch sections. Layouts of these sections can be combined in varying ways depending on the size and shape of space available, amount and structure of production, the methods selected etc. A proper integration of section layouts is required if maximum efficiency, smooth flow of operations, reduced labor and managerial control are to be achieved.

- **Topic 3:** Localization of equipment during sausage processing

Selection of the proper type of sausage producing equipment involves the consideration of a number of factors, such as type and volume of production program, labor, speed of production desired, ability to vary quickly the type of sausage, price of raw materials, cost of maintenance etc. A proper sequence of operations and a wise choice of equipment can considerably aid the economical and successful flow of operations and avoid bottlenecks impeding the process. Great care should be given to the choice and placing of machines and other equipment in such positions that not only will one be capable of performing the most effective work but also of moving raw materials and products from one operation to another with minimum contamination. Adequate importance must be given to each separate item of equipment bearing in mind that too large a machine is an unnecessary expense but, a machine which is too small, is a permanent handicap.

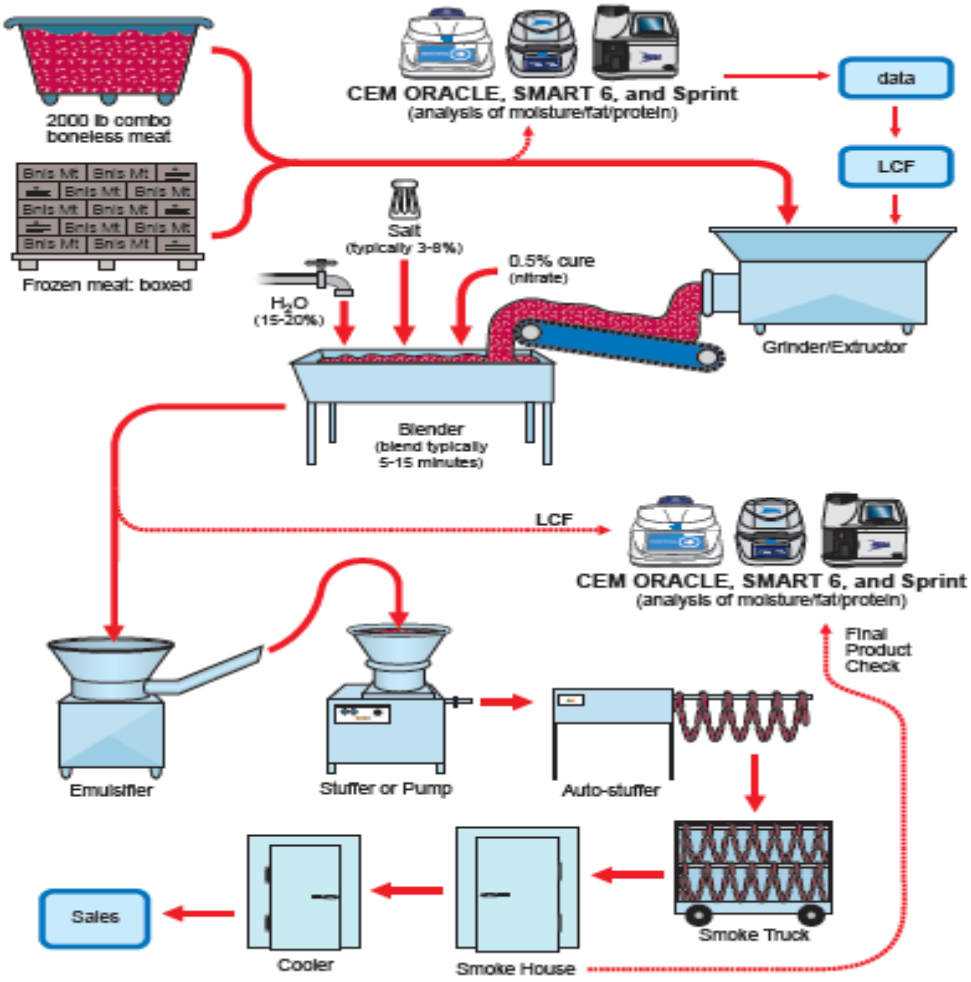


Fig. Equipment localization

Oracle: Universal Fat analyzer

Smart 6: Moisture analyzer

Sprint: Protein analyzer

- **Topic 4:**Identification of critical points in sausage making

Typical hazards along with standard control/prevention measures during sausage making.

(note: B – Biological contamination, C – Chemical contamination, P – Physical contamination.)

Table 1: Typical hazards along with standard control/prevention measures during sausage making.

Ingredients	B	C	P	Hazard Description	Control / Prevention measure
Acidifiers, antioxidants, binders/extenders, curing agents, flavorings, mold inhibitors, phosphates, sweeteners		X		Toxicological effects if limits are exceeded	Use ingredients guaranteed to meet product specifications / requirements.
Meat ingredients (beef, pork, poultry and meat by-products)	X			Growth of pathogens due to improper storage, handling, and/or transport. Foreign particle contamination (e.g., bone particles)	Product temperature must be sufficient to limit excess microbial growth. Product must meet specifications. Product must be produced under HACCP plan. Visual examination of product to identify particle contamination.
Packaging materials		X	X	Toxicological effects	Use only packaging materials certified as safe by the manufacturer.
Spices/herbs	X	X	X	Contamination from microorganisms, agricultural chemicals, and/or foreign materials	Use ingredients guaranteed by the manufacturer to meet product specifications / requirements.
Vegetables	X	X	X	Growth of pathogens due to improper storage, handling, contamination with agricultural chemicals, and/or foreign materials	Ingredient spec sheet identifying required ingredient parameters, control storage temperatures to preclude microbial growth.
Processing Steps	**B**	**C**	**P**	**Hazard Description**	**Control / Prevention measure**
Cooking	X			Survival of pathogens due to improper procedures	Time/temperature combination adequate to destroy specific pathogens.
Cooling	X			Growth of pathogens due to improper temperatures, germination of spore-forming pathogens due to slow chilling (e.g., *C. perfringens*.)	Cooked product must be cooled according to established procedures.

Drying (Meat)	X			Bacterial growth due to inadequate control over time, temperature and humidity.	Achieving specific water activity levels to inhibit the growth of pathogenic microorganisms.
Formulation	X	X		Contamination during employee handling, incorrect formulations, contamination through damaged packages.	Maintaining careful employee practices, ensure ingredients are consistent with requirements, ensure packaging is clean and intact.
Freezing (Meats)	X			Survival of parasites due to improper time/temperature application, growth of pathogens due to temperature abuse.	Rapid cooling and freezing.
Grinding	X	X	X	Contamination during handling, contamination from lubricants, contamination from damaged equipment.	Careful employee practices, careful maintenance of equipment, temperature control in grinding room (<500F).
Packaging	X	X	X	Contamination from packaging, contamination from damaged containers.	Ensure that packaging materials are protected from contamination, ensure that packaging is properly utilized to ensure adequate barrier.
Peeling	X		X	Contamination by pathogens in product accumulations, contamination from employee handling, contamination from foreign materials.	Ensure careful employee handling processes, do not allow product to accumulate in/on equipment, maintain peeling equipment in proper condition.
Receiving	X	X	X	Contamination through damaged containers, inappropriate storage conditions (temp/humidity), contamination on receiving equipment, cross-contamination from non-food chemicals, contamination from extraneous materials.	Product must be received in sound containers, and stored at appropriate temperature.

LO 1.2 Select cleaning products

- **Topic 1:** Why cleaning in sausage making?

Periodic cleaning and sanitation, which includes disinfection of meat plant premises and equipment, is an integral part of Good Hygienic Practice. 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**
- **food-borne diseases**

- **Topic 2:** Types of cleaning products

Commercially available cleaning agents in modern cleaning practices are complex compositions of either **alkaline, acid or neutral** chemical substances. In order to improve their dirt loosening properties, surface active agents, also called **surfactants** or **detergents** are added. Detergents decrease the superficial tension of water.

Alkaline cleaning agents:

Generally suitable for removing organic dirt, protein residues and fat.

Example: Alkaline cleaning agents contain strong bases like sodium hydroxide or potassium hydroxide. Bleach (pH 12) and ammonia (pH 11) are common alkaline cleaning agents.

Acid cleaning agents:

Used particularly for removal of encrusted residues of dirt or protein or of inorganic deposits (“scaling”) such as water stone, milks tone, lime etc.

Example: Hydrochloric acid, Sulphuric acid

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.

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.

Table 2: Disinfectants used in food industry

Disinfectant	**Description**
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
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
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)
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%

- **Topic 3**: Efficiency of cleaning products

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.

Best disinfection results are achieved when chemical disinfection is preceded by intensive dry/wet cleaning. Disinfection without pre-cleaning is not fully efficient as many microorganisms remain embedded in encrusted dirt, protein and fat, which cannot be properly dissolved by disinfection chemicals. Therefore, microorganisms remain protected against the disinfection chemicals. Moreover, remaining protein may inactivate chemical disinfectants.

Hot disinfectant solutions (up to 50oC) are more effective than cold ones. After application, the disinfectant solution must remain for a certain period of time on the surfaces to be disinfected as indicated in the user instructions, normally for 30 minutes. Thereafter removal of the chemicals through rinsing with potable water is needed.

The following commercially available disinfectant is an example for an efficient **combination of components**:

- organic acids
- surfactants (= surface active agents)
- peroxide compounds

The **organic acids**, apart from their sanitizing effect, decrease the pH as some disinfectants are more efficient at lower pH. The **surfactants** assist in penetrating organic material. The **peroxide compounds** have the direct antimicrobial effect by coagulation and denaturation of proteins (virus) and penetration through cell walls causing cell destruction (bacteria).

The available types of chemical disinfectants act differently on certain groups of bacteria and under certain pH-ranges. In order to achieve a maximum disinfection effect, it is recommended to **alternate periodically** the type of the chemical disinfectant applied. Utilization of suitable alternative substances will inactivate bacteria, which were possibly surviving the previous sanitation process. This procedure will also help to counteract the development of resistant bacteria in the meat plant

LO 1.3 Cleaning the work area

- **Topic 1:** General consideration

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.
- 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.

- **Topic 2:** Cleaning techniques (SOPs)

- 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 labour 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.
- **High pressure water** is efficient for surface cleaning after dry-cleaning of scrap. It serves for the removal of remaining small solid parts, blood and dirt from the entire floors and walls of processing sections as well as for the removal of meat and fat particles and layers of protein from tools and equipment. As hot water has a much better cleaning effect than cold water, hot water should be available for this purpose.
- Cleaning with equipment producing a **pressurized steam/water-mix** is even more efficient as impact temperatures of approx. 100oC can be achieved. The disadvantage of this method is the intense fog and aerosol formation, which may not only cause unwanted microbial spreading by water droplets (aerosol) but also affect installations and equipment through high humidity and excessive condensation. For these reasons a steam/water-mix is not suitable for meat processing facilities and cold or hot pressurized water cleaning is preferred.
- The removal of loose dirt and meat/fat residues by water does not mean that the cleaning was complete. Sticky or encrusted layers of fat or protein will still exist and must be removed. For this purpose, **chemical cleaning solutions** can be very effective.

- **Topic 3**: 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.

- **Topic 4:** 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.

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.

Table 3 Example of cleaning and disinfection plan (Meat grinder)

Pre-cleaning	Potable water Temp.: 40-50°C Pressure: 20-30 bars	
Cleaning	Daily Agent: A Concentr.: 1.0% Temp.: 40-50°C Time: 20-30 min pH: approx. 12	1 x monthly Agent: B Concentr.: 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	
Drying		

Disinfection	2 x weekly Agent: C Concentr.: 0.5% Temp.: 30-40°C Time: 30 min pH: approx. 5.7	3 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

Learning Unit 2: Prepare materials and equipment sausage making

LO 2.1. Select equipment and materials

- **Topic 1**: General consideration for the selection of materials and equipment

Selection of the proper type of sausage producing equipment involves the consideration of a number of factors, such as:

- type and volume of production program
- labor
- speed of production desired,
- ability to vary quickly the type of sausage,
- price of raw materials
- cost of maintenance

Great care should be given to the choice and placing of machines and other equipment in such positions that not only will one be capable of performing the most effective work but also of moving raw materials and products from one operation to another with minimum contamination. Adequate importance must be given to each separate item of equipment

bearing in mind that too large a machine is an unnecessary expense but, a machine which is too small, is a permanent handicap.

Special points to consider in the selection of any equipment are:

- appropriate material to minimize corrosion,
- robust construction in order to minimize maintenance,
- satisfactory design to enable handling and processing of meat and other raw materials and to facilitate thorough cleaning,
- capacity to meet requirements

All equipment should be provided with the necessary safeguards so that its operation will not be hazardous

- **Topic 2**: Equipment used in sausage making

Meat cutting equipment

Cutting table

Hand washing basin

Cutting knives and protecting Gloves

Protective Apron

Sharpening steel

Manual meat saw

Knife sterilizer

Electical meat saw

Meat grinder (Mincer)

The meat grinder is a sausage making tool that forces meat scraps under high pressure along a horizontally mounted cylinder with sharp-edged ribs through a series of holes in a perforated plate. As the compressed meat extrudes through the holes in the plate, a revolving four-bladed knife cuts it. The perforated plate has round holes ranging from 1 to 13 mm. The degree of comminution is most of all determined by the choice of the hole diameter in the perforated plates.

Fig. Meat grinder

Bowl cutter (Bowl chopper)

The bowl cutter is the commonly used meat chopping equipment designed to produce small or very small (“finely comminuted”) lean meat and fat particles.

Fig. Meat chopper

Modern cutters usually have dual-speed knives and a variable bowl speed; they are often equipped with a special device for emptying the bowl as well as a thermometer over the bowl to help in controlling meat temperature during chopping. They can operate under vacuum which contributes to a better colour and improves the water binding capacity of the meat.

Quite small cutters usually have a 15 to 30 litre bowl with two speeds of bowl rotation and knives rotating at 1000 to 2000 per minute. Such cutters can be operated by 12-15 HP motors. Cutters for small-scale sausage manufacturers have 25 to 50 litre bowls with a variable bowl speed and knives rotating at 1500 to 3000 per minute. Some machine manufacturers supply cutters with knives rotating at 4000 to 5000 rpm. Cutter power requirements are high: a cutter with a bowl capacity of 200 to 250 kg needs a 75 HP main motor and a 3 HP auxiliary one.

The knives should be maintained in a thoroughly sharp condition; periodically they need a superficial finish with a fine stone. The cutter knives should be adjusted to the bowl at a distance of 0.7 mm.

Sometimes meat grinder and meat chopper are combined and called ***emulsifying machine***

Filling machine ("sausage stuffer")

These machines are used for filling all types of meat batter in containers such as casings, glass jars and cans etc.

There are two well-known and proved systems used for stuffing of the emulsion in casings or in other containers. First, the common or piston filling machine, or simply, a stuffer which is a compressed air-driven or hydraulic or manually operated machine. The vertical piston stuffers are popular among small-scale sausage manufacturers. They are recommended for coarse-ground sausages but they are also useful for fine emulsion stuffing. The pump stuffers, working often on a continuous basis, are preferred by large-scale sausage manufacturers.

Fig. Sausage stuffer

Clipping machine or Linker

Clipping machines place small Aluminum sealing clips on the sausage ends and replace the manual tying of sausages. They can be used for artificial or natural casings. Clipping machines can also be connected to filling machines.

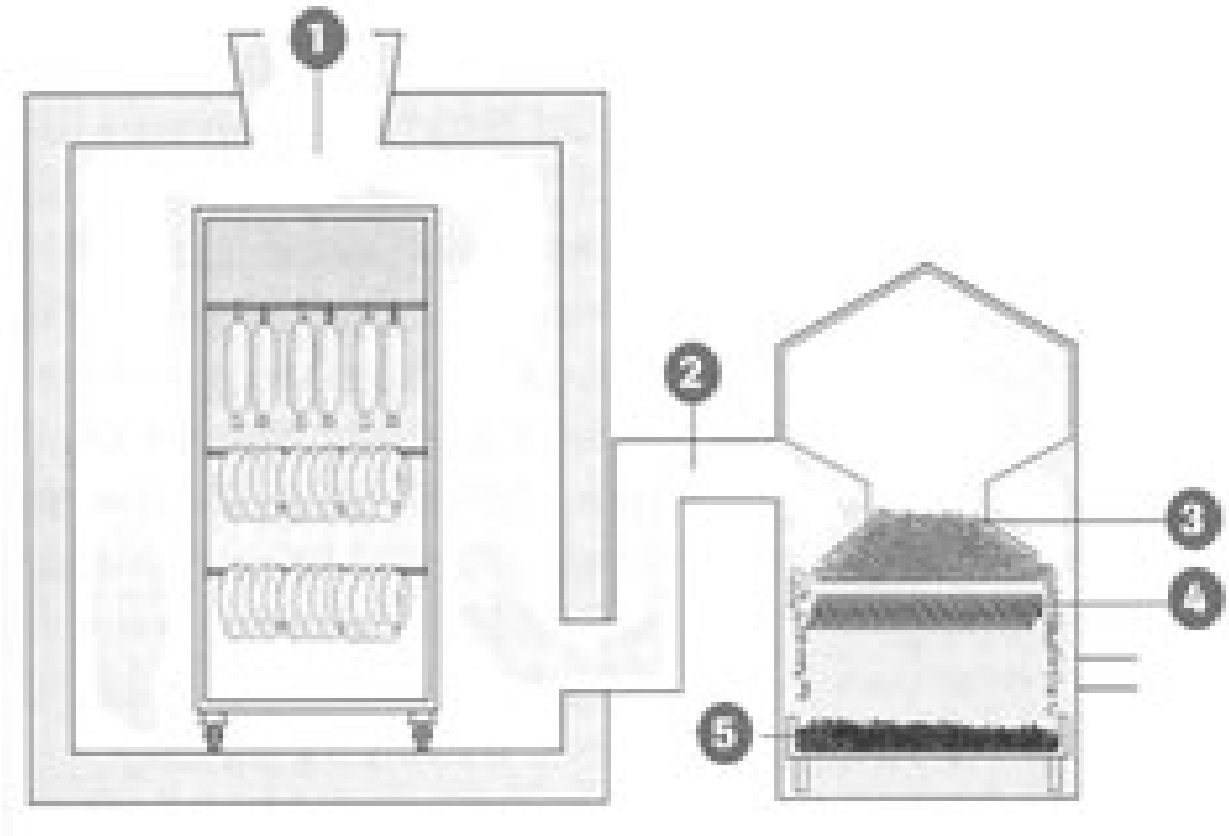
Fig. Clipping machine

Smoke house

There are two basic types of smokehouse: the simple or natural-air-circulating smokehouse and the modern or air-conditioned smokehouse. The design of a smokehouse has a great influence an obtaining uniform result.

Modern or air-conditioned (forced ventilation) smokehouses are equipped not only to smoke but also to cook and chill the sausages. Their walls are usually fully insulated. Air circulation is created by fans and humidity is controlled by steam injectors or by varying the amount of outside air introduced into the smokehouse. Air temperature is maintained by a series of connected gas-heated or alternatively heated pipes. With this type of smokehouse, especially designed sawdust smoke generators are extensively used. The generated smoke is drawn by a fan into the smokehouse. The use of generators facilitates control of the density of smoke and allows the elimination by washing of soot and other undesired particles formed during the combustion process.

Special attention must be given to the control of temperature and humidity in the smokehouse. In this respect wet-bulb (black) and dry-bulb (blue) thermometers are often used but other instruments are also in common practice. Records of these thermometers should be carefully checked each day. Keeping the smokehouse clean does much toward preventing fire and contributes to the quality and shelf life of sausages.



1. The smoking chamber;
2. The smoke pipe;
3. The sawdust or chip material;
4. Gas ignition;
5. The burned sawdust

Fig. Smoke house

LO 2.2 Clean the equipment

- **Topic 1**: Procedure for cleaning equipment in sausage making

Table 4: Procedure for Cleaning equipment in sausage making

Pre-cleaning	Potable water Temp.: 40-50°C Pressure: 20-30 bars	
Cleaning	Daily Agent: A Concentr.: 1.0% Temp.: 40-50°C Time: 20-30 min pH: approx. 12	1 x monthly Agent: B Concentr.: 1.5% Temp.: 40-50°C Time: 20-30 min pH: approx. 1.8
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Drying		
Disinfection	2 x weekly Agent: C Concentr.: 0.5% Temp.: 30-40°C Time: 30 min pH: approx. 5.7	3 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

LO 2.3 Use of equipment

- **Topic 1**: Use and calibration of thermometer

Instructions: Thermometers used for temperature measurements MUST be regularly checked for accuracy. Thermometer accuracy must be checked using a standard calibrated thermometer traced against NIST standard and recorded on the Thermometer Calibration Log. The designated supervisor must verify and initial that employees are verifying accuracy of thermometers by reviewing and signing this log.

Table 5: ***Sample Thermometer Calibration Log Form***

Date /Time	Thermometer ID number	Method used (Ice slurry /Boiling point)	Thermometer reading	Accurate (yes/no)	Correction action taken	Staff initial	Verified By /Date

- **Topic 2:** Use and calibration of weighing scale

Instructions: Scales used to weigh ingredients will be checked for accuracy each time a product is made. The scale must be checked for accuracy using a standard weight according to the manufacturer's recommendation and recorded on the Scale Accuracy Log. The designated supervisor must verify and initial that employees are verifying accuracy of scales by reviewing and signing this log. This log should be maintained for a minimum of six months.

Table 6: ***Sample weighing scale Calibration Log Form***

Date/Time	Food scale ID number	Standard weight	Scale reading	Accurate (yes/no)	Correction action taken	Staff initial	Verified By/Date

Learning Unit 3: Make smoked, cooked and dried sausages

LO 3.1: Prepare ingredients for sausage making

- Topic 1: Ingredients in sausage making

Meat as sausage ingredient

Sausage making is a great way to use less tender, low-value cuts and trim pieces. Good sausage begins with good meat. Beef, veal, pork, lamb, mutton, and poultry are all suitable for use in sausage. A majority of sausage products are prepared with pork and beef. Often game meats can be used to make sausage. If you slaughter your own animals, meat from the head, trimmings, and the thin cuts can be saved for sausage. Meat from the neck and back of poultry and meat from the entire carcass of spent fowl can also be used.

Word of caution:

- Meat should be handled properly after the animal is slaughtered and kept cold (Below 40^{o}F)
- Always be sure to remove any meat that is slimy, has an off-odor, or is dirty.

Non meat ingredients in sausage making

Salt: is an essential ingredient for flavor and functionality in sausage. It aids in the water binding and emulsifying capacity of meat proteins. Use of salt alone provides a dry salty product, which gives the sausage a bitter taste of salt and an unattractive color. Salt should be pure and sufficiently finely granulated so it can dissolve easily in the meat. Salt is necessary for enhancing flavor, preserving the sausage from microbial spoilage, and extracting the soluble meat proteins. The extracted meat protein forms a film and coagulates during heating and binds the meat particles together providing a firmer texture for sausage. Most sausages contain 2–3 percent salt. Salt levels can be adjusted to your taste.

Sugar is used for flavor development and to counteract the slight, bitter taste of salt. A variety of sugar sources can be used to provide sweetness and flavor to sausage. These include sucrose (table sugar), brown sugar, dextrose, and corn and maple syrup. Sugar is also used as a substrate for microbial fermentation to reduce the pH of the dry and fermented sausage. The lactic acid produced due to fermentation reduces the pH of the meat and gives sausage a characteristic tangy flavor.

Spices are found many forms: fresh, dried, whole, crushed, pureed, as paste, and as an extract. The commercial meat processing plants use spice extracts in place of natural spices. Seasonings and spices used for sausage making should be fresh. Most consumers prefer the taste of freshly made food that often comes from spices. However, spices are also known to be a source of microbial contamination. For the best outcome, buy the best spices with the greatest purity. Most spices lose their natural flavor when held for six months or more at room temperature. For the best results, store seasonings and spices at 55º F (13° C) or below in airtight containers. Remember, the characteristic flavor of a sausage comes from the spices, herbs, and flavorings that are used, so buy the best quality seasoning that you can get.

Nitrates and Nitrites The use of nitrite to preserve and cure meats evolved centuries ago. It is one of the oldest forms of food preservation. It has great benefit for the production of sausage with improved food safety with extended shelf life and excellent storage stability. Many of today's cured sausage products enjoyed by consumers contain sodium nitrite.

Curing imparts unique colors, texture, and flavors that cannot be recreated by any other ingredient. These curing ingredients are required to achieve the characteristic flavor, color, and stability of cured meat.

Nitrate and nitrite are converted to nitric oxide by microorganisms and combine with the meat pigment (myoglobin) to give the characteristic pink cured-meat color. However, more importantly, nitrite provides protection against the growth of botulism-producing microorganisms, acts to retard rancidity, and stabilizes the flavor of cured meat.

Binders and Extenders Sausages may contain other ingredients such as binders and/or extenders to retain natural juices and reduce the cost of the formulation. These ingredients help may improve the binding characteristics, flavor, cook yield, slicing characteristics, and reduce the cost of the sausage formulation (i.e., extenders). The most commonly used ingredients of this type are non-fat dry milk, cereal flours, and soy protein products. You may use these ingredients in most sausage products, depending on your taste. If you use soy, wheat, egg, or milk products in your formulation, be sure you declare them in the allergen statement on your label.

Water is added to most sausage formulations to rehydrate the nonfat dry milk and to replace the expected moisture loss during smoking and cooking. Approximately 10 percent added water typically is used in moist types of cooked sausage. A small amount of water (usually less than 3 percent) is added to fresh sausage to aid in stuffing, mixing, and processing. No water is added to sausages that will be dried, such as summer sausage or pepperoni.

Acidifiers (Fermenters) in sausage making

Starter Culture is an inoculum of bacteria that produce lactic acid from sugar. Sausage processors can use a starter culture for making a batter for summer sausage, snack sticks, etc., prior to filling and stuffing. In order to get successful fermentation and lactic acid production, the stuffed sausages must be held at temperatures favorable for bacteria growth (80–100° F) for 10 to 15 hours minimum to allow the starter culture bacteria to grow and ferment the sugar to lactic acid. A noticeable aroma is usually present during this fermentation period indicating that fermentation is indeed occurring. Without an effective starter culture in the batter to rapidly produce acid, these abusive fermentation temperatures

can pose a microbiological safety risk by allowing dangerous bacteria to grow in the meat product.

Encapsulated Acids Many meat processors have started to use encapsulated citric or lactic acid to the batter for the acidification of their sausage. Encapsulated acids are small beads of acids enclosed in a lipid coat. These acids are gently blended into the batter near the end of final mixing do not grind the meat after mixing and don't damage the lipid coat. The sausage can be cooked immediately. When the batter temperature reaches 137° F, the lipid coat melts, releasing the acid.

Direct addition of acid must be done in this encapsulated form because direct addition of unprotected acid to the batter during mixing would cause the meat proteins to coagulate while still in the mixer, ruining the product texture. Encapsulated acids are the easiest way for home meat processors to get a tangy flavor into their summer sausage. If used correctly, it is almost impossible to tell if the sausage was manufactured by fermentation or by the use of the encapsulated acid.

Encapsulated acids are a simple way for the meat processors to give a tangy flavor to their sausages. Care must be exercised while using the encapsulated acids. Mixing for too long or cooking at too low

Antioxidant in sausage making

Antioxidants are approved for use in fresh sausages to retard oxidative rancidity and protect flavor, including butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), propyl gallate, tertiary
butylhydroquinone (TBHQ), and tocopherols. These compounds are added to spice mixtures based on the actual percentage of fat in the fresh product formulations (typically 0.01 percent separately, 0.02 percent in combination) or on the total meat block weight for dry sausage formulations (typically 0.003 percent).

Reducing agents in sausage making

Ascorbates and erythorbates are chemicals used interchangeably in cured sausages to which nitrite has been added. They are active reducing agents that react with nitrite to accelerate the curing process. Examples of reducing agent ingredients are given in Table below. Sodium erythorbate is chemically similar to ascorbate, and both can be used as "cure accelerators" as an optional ingredient. Note that many recipes call for holding the meat overnight to cure. This is required to allow the bacteria to convert the nitrite to nitric oxide. The addition of ascorbic acid (Vitamin C) or sodium erythrobate speeds the curing reaction and eliminates the holding time. USDA regulations allow the use of up to 7/8 ounce per 100 pounds of meat.

Table 6: Examples and maximum amount of Antioxidant in sausage making

Antioxidant	**Maximum amount**
Ascorbic acid	3/4 oz. per 100 pound of meat
Erythorbic acid	3/4 oz. per 100 pound of meat
Sodium erythorbate	7/8 oz. per 100 pound of meat
Citric acid	May replace 50% of the above listed ingredients.
Sodium Citrate	May replace 50% of the above listed ingredients.
Sodium acid pyrophosphate	Alone or in combination; should not exceed 8 oz. (0.5 percent)
Glucono delta lactone	8 oz. per 100 pound of meat

Molds inhibitors

Mold is a commonly encountered problem in the production of dry sausages. The common technique for preventing the growth of mold is to dip the sausage in a mold inhibitor solution, typically 2.5 percent solution of potassium sorbate or a 3.5 percent solution of propyl paraben.

Casings

Sausages may be formed into loaves and oven baked. However, most sausages are either wrapped or packaged in bulk chub packs or stuffed into casings. Two types of sausage casings are natural and synthetic. Natural casings are obtained from the digestive tract of animals. These casings are made from sheep (3/4-inch in diameter), hog (1-3/8 inches) and cattle (1-3/8 inches) intestines.

Edible synthetic casings made from collagen are also available, in approximately the same sizes as the natural casings.

- **Topic 2:** Weighing and measuring of ingredients

Weighing or measuring the meat and spice ingredients is one of the most important steps in the preparation of a good sausage. Always calibrate your scale before using it to weigh out the proper amounts of lean meat, fat meat, and each individual spice or added ingredient, to be sure that the formulation is correct. There is nothing more disappointing than to make sausage that is too hot or spicy or not properly seasoned. If it is not possible to weigh the ingredients, be sure to measure them properly. Remember, weights are always more accurate than measures.

- **Topic 3**: Mixing of ingredients

Mixing the meat and other ingredients is a simple but important step. Before the spices and dry materials are added to the meat, cut the meat into 1-to 2-inch squares. Spread the meat in the bottom of a large pan. Sprinkle the spices and dry ingredients over the meat and mix thoroughly. Add water, ice, or wet ingredients last and mix again. This mixing will ensure a uniform distribution of spices and develop the binding ability of the meat. If nitrate or nitrite is to be used in the formula, dissolve it in a small amount of water before adding. This will ensure a uniform distribution throughout the sausage.

LO 3.2 Grind the mixture

- **Topic 1**: Procedure

The first step in sausage production is grinding the ingredients. The grinding stage reduces the meat ingredients into small, uniformly sized particles. Ground meat is the primary ingredient in a sausage formulation. The characteristics of the meat ingredients used to create the sausage define the type of sausage -the overall taste, texture, aroma, along with the protein and fat content.

Meats must be clean, sound, and wholesome. These products should be inspected when arriving at the facility, and just prior to use, to ensure that they were not contaminated during transit or handling.
The specific meats used in a sausage formulation must be correctly identified by type and quantity.

Prior to grinding, the meat is held in cold storage. Although the Food Code requires the meat to be held at 41°F or less, often processors prefer to chill the meat to below 30°F to minimize the potential for fat smearing. The grinder blades must be sharp and matched with the grinding plate to ensure an efficient grind without generating extra heat during the grinding process.

Grinding processes will vary according to the manufacturer and the nature of the product. Some sausage products use coarsely ground meats, others use more finely ground meat ingredients. Some manufacturers grind the lean and fat trimmings separately, grinding the lean trimmings to a finer consistency than the fat meats.

- **Topic 2:** Addition of ingredients

Large-volume production of cooked sausages is frequently carried out in a mixer–grinder system. In such a system, the all-in method is used. Frozen, semi frozen and/or chilled meat and fat materials are flaked, chipped or minced and placed in a large mixer, typically a paddle or ribbon mixer. If fat or skin emulsions are used, they are added to the mixer at the same time as all the other meat and fat materials. All the additives are mixed in; then the ice and water are introduced and mixing continues until all the ice and water is properly absorbed and a tacky mass is obtained. Generally, the amount of ice and water introduced is between 20% and 35%, while the amount of lean meat varies greatly, between 20% and 40%. Fat is

commonly present at between 22% and 30% and additives, or compounds of additives, are applied between 4% and 15%. A low-cost frankfurter would contain around 60% hard MDM, 5–10% skin emulsion, 15–20% water or ice and 10% additives, with proteins such as soy commonly being among the additives. The percentages of the different ingredients vary greatly, based on the expected cost structure and quality of the product being made.

- **Topic 3:** Temperature control

The temperature of the meat and fat materials in conjunction with added water or ice is adjusted so that, after a certain period of mixing, generally between 5 and 10 min, the mixed and tacky mass has a temperature of around 2–6 °C. Mixing occasionally takes place under a vacuum. The mixed mass is then passed through an emulsifier, or colloid mill, and the high shearing forces experienced as the emulsion passes through the emulsifier activate high levels of protein. Fat is cut down to a size that is not visible in the final product after passing through the emulsifier and the sausage mass has a final temperature of around 8–12 °C.

LO 3.3: Stuff or fill sausages into casings

- **Topic 1:** Casings preparation

Use the following steps to prepare casings for use:

1. Remove the amount of casings needed from the storage container and cut into 3 to 6 foot lengths for easier handling.
2. Remove the salt by rinsing casings in running water and then soak for one to two hours prior to use. This allows time for the casings to become soft and workable.
3. Before stuffing, insert two fingers into one end of the casing to open and separate it, then hold under the faucet and let water run through the entire length.
4. Pack sausage as directed in the recipe.
5. Rinse any leftover casings in cold water and thoroughly drain. Then re-pack the casings in a layer of salt in the original container. These will remain usable for about one year.

- **Topic 2:** Stuffing process

The stuffing process can be accomplished in a number of ways. Natural casings are typically flushed with water, and the mixture is injected into the casing at a pressure that is sufficient to fill the casing without leaving any air pockets, and without tearing the casing. The stuffing process is also sometimes conducted at lower temperatures (<35-380F) to minimize fat smearing on the casing.

Smaller volume or specialty producers may stuff the formulation into the casing by hand or from a screw feed. These small operations may also bypass choppers, mixers, and stuffers, and stuff the output of the grinder directly into the casing. Larger manufacturers may use air or water-piston type automatic stuffers.

- **Topic 3:** Linking

The stuffed casings are then separated into uniform segments of equal length in a process called linking. These segments form the single sausage portions. The linking process is typically accomplished by twisting the casing.

LO 3.4: Smoke the sausage

- **Topic 1:** Purpose of sausage smoking

The following are the reasons for smoking sausage:

- Meat preservation in order prolong its shelf life: Smoking at high temperature cooks the meat and this destroy the bacteria and enzymes. Some chemical components of the smoke contribute to make the medium unfavorable for the growth of microorganisms.

- For taste, to improve flavor by ephenolic compounds and droplets.
- Development of color: *Interaction of carbonyl groups with animal proteins*
- Protection from oxidation.
- Smoking eases attraction between the casing and muscle.
- Smoke impacts textural changes, through the loss of solubility of myofibrillar protein and by cross linking of surface proteins

- **Topic 2:** Source of smoke

A smoke generator creates natural smoke via a carefully controlled burning of hardwood sawdust, wood chips, or logs. Hickory is the most popular wood used for smoking, but other hardwoods and fruitwoods are also used. Coniferous trees such as pine are unacceptable because they contain resins, smoke from that type of wood has a high tar content and imparts a bitter flavor.

- **Topic 3:** Smoking techniques

Hot smoking

Is used when the product is to be partially or completely cooked. In hot smoking, the first stage (approximately 30 minutes, without smoke, at 105–125° F) results in the pre-drying of the surface and is followed by several stages of smoking in dense, hot smoke (at temperatures reaching 185°F) and further surface drying. Hot smoking is a more flavorful cooking process the smoke is added to the product during the cooking cycle.

Cold smoking

Is used in manufacturing raw, fermented sausages made from cured meats. Cold smoking is basically a drying process that adds the smoke color and flavor to the product. Cold smoking takes place in the range of 53.6–77° F and warm smoking at 73.4–113° F. The smoke, at 53.6–77° F and controlled humidity, is applied for several hours up to about 16 days, depending on the assortment.

Liquid smoke

May be used in the sausage formula if a smoke flavor is desired and no smoking equipment is available. Use about a half-teaspoon of liquid smoke to one pound of sausage. Dilute this in the water added to the meat before mixing to get good distribution.

LO 3.5: Dry the sausage

- **Topic 1:** Purpose of sausage drying

The drying process is a critical step in ensuring product safety. FSIS requires that these products undergo a carefully controlled and monitored air drying process that cures the product by removing moisture from the product. Pork-containing products must be treated to destroy trichinae. Sausages not containing pork have no such requirement.

- **Topic 2:** Procedure of drying

The drying process consists of placing the product in a drying room under a relative humidity of 55-65%, in a process that can last from 10 days to as long as 120 days, depending on the product diameter, size, and type. The drying process is designed to produce a final product with approximately 30 – 40% moisture, and an MPR generally of 1.9:1 or less, to ensure proper drying and a safe product. Facilities must keep accurate records of the temperature and the number of days in the drying room for each product manufacturing run to help ensure product safety and consistency.

LO 3.6: Package and store the sausage

- **Topic 1**: Purpose of packaging sausage

The basic purpose of packaging is to protect sausage from undesirable impacts on quality including microbiological and physio-chemical alterations. Packaging **protects** sausage during storage and distribution from:

- **contamination by dirt** (by *contact with surfaces and hands*)
- **contamination by micro-organisms** (*bacteria, moulds, yeasts*)
- **contamination by parasites** (*mainly insects*)
- **contamination by toxic substances** (*chemicals*)
- **influences affecting colour, smell and taste** (*off-odour, light, oxygen*)
- **loss or uptake of moisture** (*evaporation* or *water absorption*

- **Topic 2:** Packaging sausage

The final sausage product is often packaged prior to sale. Packaging typically consists of wrapping the product in plastic film.

- **Topic 3:** Requirements for sausage packaging

Packaging films must be/have:

- flexible
-mechanical strength
-light barrier
-odourless
-hygienic (clean and toxicologically harmless)
-easy recycling
- resistance to hot and cold temperatures
-resistance to oil and fats
-good barrier properties against gases
-sealing capability
- low-cost
- Easy to open

- Packaging materials for sausage

Practically all films used for meat packaging derive from **synthetic "plastic" materials**

The most common **synthetic materials** used for meat packaging are:

-Polyethylene (PE)

- Polypropylene (PP)

- Polyvinylchloride (PVC)

-Polyester (PET)

-Polyamide (PA)

-Polyvinylidenchloride (PVDC)

- Ethylenvinyl alcohol (EVOH)

- Labelling of sausage

Each container of sausage shall have a legibly and indelibly label marked with the following information:

a) Name of the product (of meat used) as appropriate;

b) Country of origin;

c) Declaration as either “raw”,” cooked” “smoked’’;

d) Declaration of method of drying;

e) Declaration of preservatives used;

f) Name and physical address of the manufacturer;

g) Net Weight content;

h) List of ingredients;

i) Batch or code number;

j) Date of manufacture shall be clearly shown on the container;

k) Expiry date shall be clearly shown on the container;

l) Instructions for use and storage.

- Storage of sausage

The length of time a sausage can be stored depends on the type of sausage. Fresh sausage is highly perishable and will only last seven to 10 days under refrigeration (35° to 40° F). However, it may be frozen for four to six months if wrapped in moisture-vapor proof wrap (freezer paper) or freezer-weight zip bags. Smoked sausages that contain salt and nitrite and have been cooked, may last from two to four weeks under refrigeration. These types include

smoked, Polish, cotto-salami and bologna. Summer sausages that have been fermented to produce the acidic tangy flavor are more durable and may be stored for several weeks in the refrigerator

LO 3.7: Keep the quality of sausage

- Temperature

One easy way to increase sausage shelf life is to lower the temperature of all rooms need in the processing, and storage of meats and sausages. The meats undergoing sausage processing should be processed at such temperatures that bacterial growth cannot occur until the pH and water activity values are sufficiently reduced to inhibit microbial action.

Table 7: Expected sausage shelf life at various temperature

Sausages	No refrigeration	10 – 15°C	0 – 4°C	Freezing
fresh	several hours	1 – 2 days	2 – 4 days	about 5 – 7 days; if protected 1 – 3 weeks
semidry	several hours	10 – 15 days	not recommended	
dry	1 – 5 weeks	3 – 6 weeks	not recommended	
smoked, precooked	10 – 15 hours		2 – 4 days (often more)	1 – 3 weeks
emulsion-type	8 – 12 hours	1 – 3 days	3 – 5 days	6 – 10 days
cooked	several hours		2 – 3 days	some varieties may be kept frozen for 2 – 3 weeks

- Water activity

The amount of water needed for growth depends upon many factors — nature of the organisms, available nutrients, etc. When the composition of a sausage product is appropriately formulated, the amount of water required for microbial growth may considerably be reduced and the sausage product shelf life increased.

The state of water in sausages has a direct effect on microbial, chemical and enzymatic reactions. This water activity or the a_w-value, also sometimes expressed as the “free” water content in the sausage, is by definition the quotient of the steam pressure present in the meat and the saturation steam pressure of the pure water under identical temperature conditions (P_s/P_o). The a_w-value of a water-free substance equals 0, that of distilled water, 0.1.

- Control of sausage spoilage and deterioration.

The main forms of sausage spoilage and deterioration are the excessive proliferation of bacteria in the sausage content or on the surface, the excessive growth of moulds on the sausage surface, the oxidative deterioration of sausage fat causing product rancidity, and the excessive dehydration of sausage superficial layers including casings.

The rate at which these four forms of spoilage and deterioration can occur vary widely. For example, processing under unhygienic conditions may cause souring, gas formation, off-odours, etc. within a few hours after production or the spoilage process can be somewhat delayed and will develop during a longer time period, perhaps in the consumer's home. High storage temperatures and high humidity, poor handling and other adverse conditions may similarly accelerate bacterial and fungal development, especially on the surface of the products. On the contrary, dry air atmosphere, high temperatures and particularly high air circulation rates contribute essentially to development of rancidity and surface dehydration, often accompanied by discoloration and other organoleptic changes.

Surface spoilage, especially of sausage products containing enough moisture, is normally shown either by the appearance of slime, because of excessive bacterial proliferation, or by an abundant generally greyish-white growth of mould. A somewhat lower storage temperature and especially non excessive dehydration of the surface may be helpful in this regard and may retard spoilage considerably. If spoilage occurs in the interior of the sausage, it is usually due to adverse hygienic production conditions as well as to the poor hygienic quality of processed raw materials.

Mould formation on sausage products is generally the result of keeping them in damp, poorly ventilated rooms or of improper packaging. Of the known mould fungi, the *Aspergillus, Penicillium* and *Mucor* species are especially apt to establish themselves on sausages, the

surface of which they cover first with their white and then grey or greyish-green tufts. It should be noted that these changes are basically of a superficial nature and do not otherwise adversely affect the sausages. Slightly or moderately mouldy sausages are, as a rule, neither injurious to health nor spoiled. After removal of the mould by washing with vinegar or a salt solution they can be passed as food. Only when highly spoiled and with a marked mouldy flavour, the sausage is unfit for consumption.

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