

CLEANING AND SANITATION IN MEAT PLANTS

Periodic cleaning and sanitation¹, which includes disinfection of meat plant premises and equipment, is an integral part of Good Hygienic Practice (GHP, see page 341). 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 prepacked 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.

How to carry out meat plant cleaning and sanitation

a) General

Preconditions for efficient cleaning and sanitation are:

- Premises and equipment must be “cleaning-friendly” (see page 364), 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.

¹⁾ 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.

b) 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 labour and time-intensive (Fig. 488). 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 $\leq 15\text{cm}$ 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 (Fig. 489).



Fig. 488: Manual cleaning of working tables with brushes



Fig. 489: Cleaning of wall with pressurized water - care must be taken not to contaminate equipment

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. 100°C 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.

Application can be by hand using brushes or scrapers for dismantled equipment or in general for smaller surfaces to be cleaned. Mechanical cleaning with high pressure equipment together with cleaning solutions is used for larger floor and wall areas as well as working tables, containers and equipment.

Traditional cleaning substances for manual use are **alkalines**, such as sodium carbonates (Na_2CO_3 , washing soda). These substances are efficient in dissolving proteins and fats, but may cause corrosion in tools and equipment, if their pH is 11 and above.

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. Water can then penetrate into the small spaces between dirt particles and surfaces (Fig. 490), where those particles are attached, thus facilitating their removal. For fat removal by pressurized hot water, cleaning detergents are important as they keep the fat dissolved and prevent fats settling down after the water temperature has decreased. Detergents may have additional cleaning components such as chlorine, silicate or phosphate. It is important that manufacturers indicate the type of the substance, either alkaline, acidic or neutral on the product label.

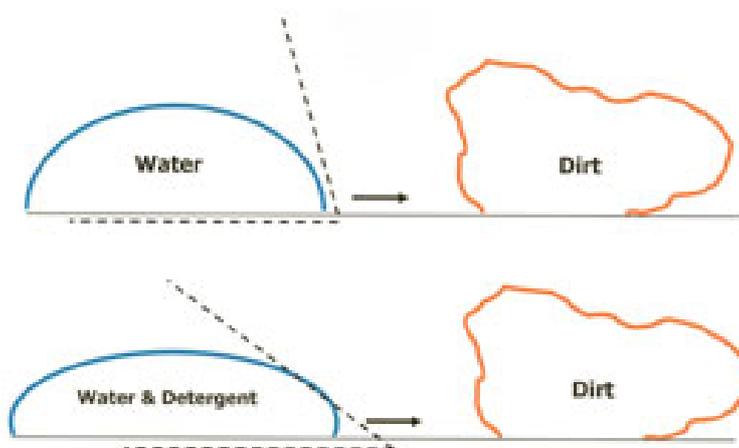


Fig. 490: Effect of detergents (surfactants): Decrease of surface tension of water droplets and impact angle (below), dirt particles are easier loosened and removed from surface.

Alkaline cleaning agents:

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

Acid cleaning agents:

Used particularly for removal of encrusted residues of dirt or protein or of inorganic deposits ("scaling") such as waterstone, milkstone, 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** (Fig. 491). 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.

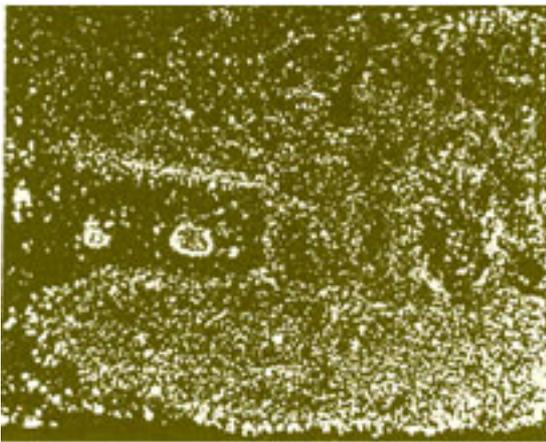


Fig. 491: Foam cleaning

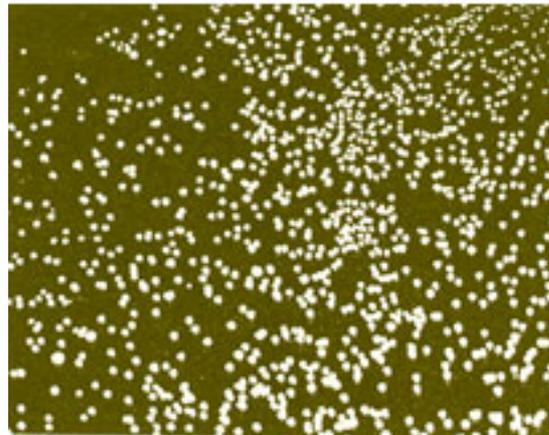
c) Disinfection techniques

Cleaning reduces a substantial amount of microorganisms (Fig. 492b) 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.

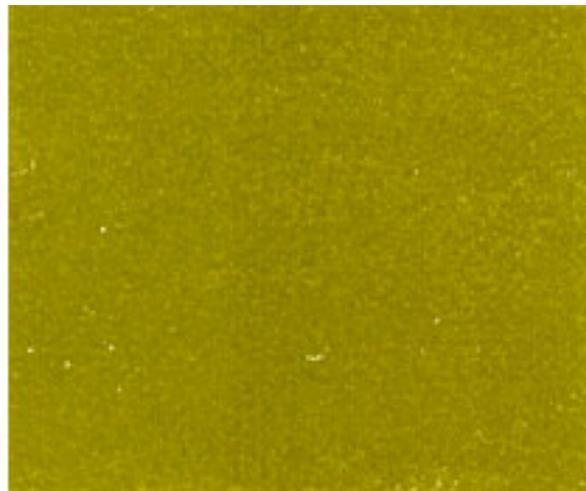
The elimination of microorganisms is achieved through **disinfection**¹⁾, either by using hot water (or better steam) or chemical disinfectants (Fig. 492c). **Chemical disinfectants** are preferred for most applications in the meat industries as they are easy to use and do not involve the risk of accidents or other negative side effects such as damage to equipment by generating high humidity or water condensation, which may occur when using steam.



Uncleaned (rinsed only) (a)
Many bacterial colonies (white spots)



After chemical cleaning (b)
Reduced numbers of bacterial colonies



After cleaning and disinfection (c)
Very few bacterial colonies remaining

Fig. 492: Effect of cleaning and disinfection on the number of bacteria
Image of impression plate samples (see page 332) taken from a meat container (plastic)

¹⁾ Disinfection in the food sector does not aim at the complete absence of microorganisms (such as sterilization of surgical instruments in hospitals), but the number of microorganisms must be substantially reduced by the process.

Best disinfection results are achieved when chemical disinfection is preceded by intensive dry/wet cleaning (see page 370, b). Disinfection without precleaning 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.

Adequate rinsing with water after cleaning and prior to disinfection is also indispensable, as chemical disinfectants may be neutralized by remaining cleaning substances. All this has to be taken into account, otherwise the disinfection procedures may be inefficient and a waste of money.

A compromise on this issue is proposed by the chemical industry by offering so called combined **disinfection/cleaning** agents. They are made on the basis of *quaternary ammonium compounds*, which have surfactant and disinfectant properties. The combined method should be considered only in cases of very little dirt contamination.

It is very important that disinfection chemicals are strictly used according to the specifications given by the suppliers. Lower concentrations and shorter impact periods than prescribed will considerably reduce the efficacy of disinfection or make it totally inefficient. Surfaces should be **dried** after cleaning and rinsing before starting disinfection. This is important, as the concentration of the disinfection solution would be lowered with remaining water on the surfaces and possibly ineffective when becoming too highly diluted.

The application of chemical disinfectants is done with stationary or mobile spraying devices. In medium or small scale meat plants, mobile spraying devices are sufficient (Fig. 493). The disinfectant is applied by means of spraying lances and manual or electrical pumps. One important rule is, that the disinfectant solution must be applied from **top to bottom**, i.e., first upper parts of walls, then lower parts of walls and the floor last. The same applies to equipment.



Fig. 493: Disinfection of walls by using portable spray equipment. For operator's protection gloves and facemask are recommended.

Hot disinfectant solutions (up to 50°C) 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.

d) Disinfectants for the meat industry

Disinfectants should be effective and rapidly acting in killing microorganisms (Fig. 494). 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 vary 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. In principle the following groups of substances are used:

- | | | |
|---|---|--|
| 1. Chlorine containing compounds
a) Na - or Ca-hypochlorite (Na/Ca O Cl)
b) Gaseous chlorine (Cl ₂)
(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)
Phenols / 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 (H_2O_2)
 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 $>1\%$

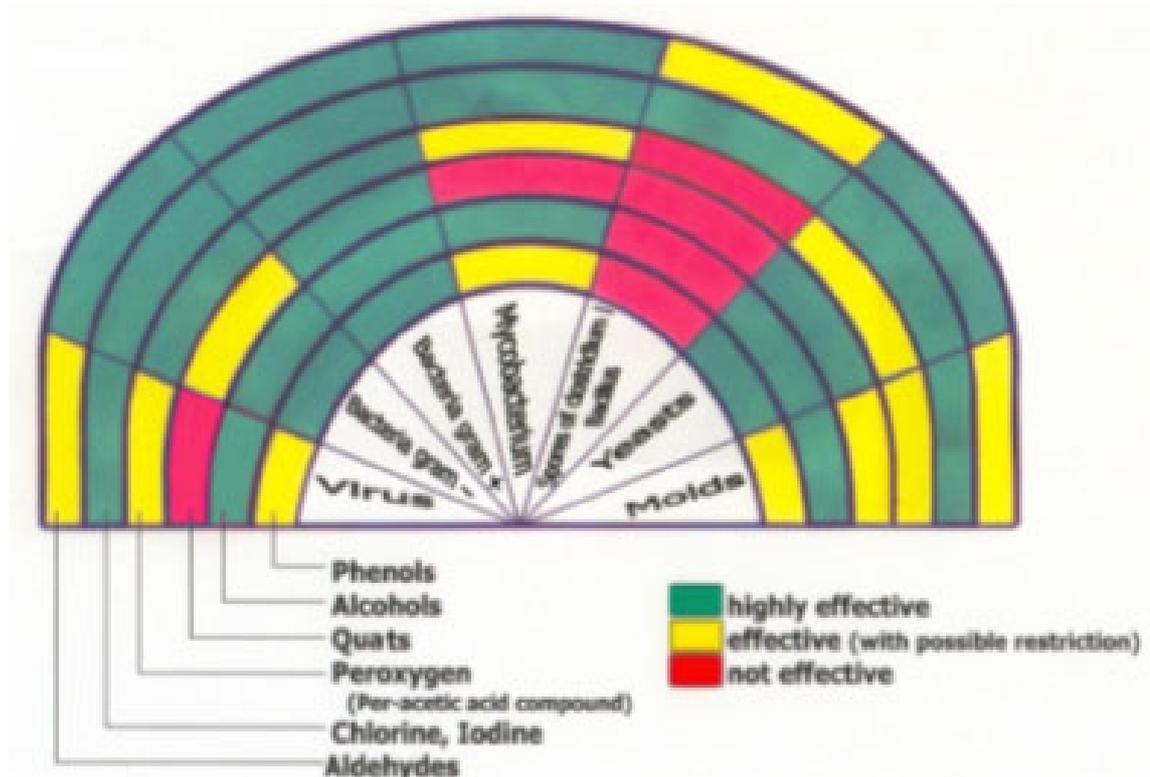


Fig. 494: Effect of some chemical disinfectants on microorganisms

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 (see "Cleaning and sanitation plan", table 22).

e) 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.

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 22, 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 22: Cleaning and disinfection plan (example)Equipment: 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 substanceAgent **B**: Acid cleaning substanceAgent **C**: DisinfectantAgent **D**: Disinfectant chemically different from C and supplementing impact of C

ANNEX I

RECIPES FOR PROCESSED MEAT PRODUCTS

Fresh meat products

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Please note:

The term NITRITE CURING SALT used in some of the recipes refers to a standard mixture of common salt with the curing agent sodium nitrite. The premix consists of 99.5% salt and 0.5% nitrite.

FRESH MEAT PRODUCTS

BOERWORS / South African BBQ sausage

(Fresh sausage type, coarse mixture)

INGREDIENTS

Raw materials: (calculated for 10 kg batch)

90.00 %	Beef trimmings without tendons	9.000 kg
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Extenders:

4.00 %	Rusk (baked and crushed wheat flour)	0.400 kg
3.00 %	Water, potable	0.300 kg
3.00 %	Vinegar	0.300 kg

Additives:

(per kg of raw materials)		(total for 10 kg)
18.00 g	Common salt (refined)	180.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
2.00 g	White pepper, ground	20.00 g
1.50 g	Coriander, ground	15.00 g
0.50 g	Thyme	5.00 g

PROCESSING

CUT	Fresh meat trimmings into small pieces
SOAK	Rusk in added potable water
MIX	Meat trimmings, rusk, vinegar and seasonings
GRIND	Mixture 3 mm
STUFF	Into natural sheep casings (26-28 mm)
PORTION	Link into sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 4 days
PREPARE	Fry in a frying pan or roast on a grill

LONGGANISA / Philippine BBQ Sausage***(Fresh sausage type, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

60.00 %	Pork trimmings, fresh	6.000 kg
40.00 %	Pork belly without rind	4.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
7.00 g	Nitrite curing salt	70.00 g
7.00 g	Common salt (refined)	70.00 g
2.50 g	Phosphate	25.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
50.00 g	Sugar (refined)	500.00 g
20.00 g	Pineapple juice	200.00 g
10.00 g	Anisado wine	100.00 g
20.00 g	Garlic, fresh	200.00 g
5.00 g	Black pepper, ground	50.00 g

PROCESSING

CUT	Fresh meats into small pieces
MIX	Fresh meats, additives, seasonings
GRIND	Meat/seasonings mixture 5 mm
MIX	All ground materials thoroughly
STUFF	Into natural sheep casings (22-24 mm)
PORTION	Link to sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 4 days
PREPARE	Fry in a frying pan or roast on a grill

**

CHICKEN LONGGANISA

see page 191

MERGUEZ / French BBQ Sausage*(Fresh sausage type, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

40.00 %	Beef meat trimmings	4.000 kg
35.00 %	Mutton meat trimmings	3.500 kg
10.00 %	Beef muscle and brisket fat	1.000 kg
5.00 %	Mutton fats	0.500 kg
5.00 %	Green pepper, fresh	0.500 kg
5.00 %	Onions, fresh	0.500 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
15.0 g	Common salt (refined)	150.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
2.0 g	Black pepper, ground	20.00 g
1.0 g	Chilli, ground	10.00 g
5.0 g	Garlic, fresh	50.00 g

PROCESSING

CUT	Fresh meats and fats into small pieces
GRIND	Meat and onions 13 mm, muscle and brisket fat 5 mm
MIX	Ground meat and fat with seasonings
GRIND	Meat/seasonings mixture 5 mm
STUFF	Into natural sheep casings (22-24 mm)
PORTION	Link to sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 4 days
PREPARE	Fry in a frying pan or roast on a grill

CHORIZO CRIOLLO / Latin American BBQ sausage*(Fresh sausage type, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

75.00 %	Pork meat trimmings	7.500 kg
20.00 %	Beef meat trimmings	2.000 kg
5.00 %	Pork back fat	0.500 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
16.00 g	Common salt (refined)	160.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
4.00 g	Pepper, ground	40.00 g
3.00 g	Pepper, broken corns	30.00 g
3.00 g	Red wine	30.00 g
1.00 g	Cane sugar	10.00 g
1.00 g	Garlic, fresh	10.00 g

PROCESSING

CUT	Fresh meat trimmings into small pieces
MIX	Meat trimmings, additives and seasonings
GRIND	Mixture 5 mm
STUFF	Into natural hog casings (24-26 mm)
PORTION	Link to sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 4 days
PREPARE	Fry in a frying pan or roast on a grill

SALCHICHA MADRILENA / Spanish BBQ sausage*(Fresh sausage type, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

50.00 %	Pork meat without tendons, lean	5.000 kg
50.00 %	Pork belly without rind, fresh	5.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
18.00 g	Common salt (refined)	180.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
10.00 g	Paprika, sweet-red	100.00 g
3.00 g	Red pepper	30.00 g
3.00 g	Marjoram	30.00 g
0.50 g	Garlic, fresh	5.00 g

PROCESSING

CUT	Fresh meat trimmings into small pieces
MIX	Meat trimmings and seasonings
GRIND	Mixture 3 mm
STUFF	Into natural sheep casings (20-24 mm)
PORTION	Link to sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 4 days
PREPARE	Fry in a frying pan or roast on a grill

BRATWURST / German BBQ sausage*(Fresh sausage type, coarse meat mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

50.00 %	Pork trimmings, lean, fresh	5.000 kg
30.00 %	Pork belly without skin, fresh	3.000 kg
20.00 %	Beef trimmings, lean	2.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
15.00 g	Common salt (refined)	150.00 g
1.50 g	Phosphate, plain (>pH 7.3)	15.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
50.00 g	Onions, fresh	500.00 g
2.00 g	White pepper, ground	20.00 g
0.30 g	Ginger, ground	3.00 g
0.30 g	Cardamom, ground	3.00 g
0.20 g	Nutmeg, ground	2.00 g

PROCESSING

CUT	Pork meats and onions in small pieces
GRIND	Beef trimmings 3 mm
MIX	Fresh pork meat, onions, ground beef, seasonings
GRIND	Meat/onion/seasonings mixture 5 mm
MIX	All ground materials thoroughly
STUFF	Into natural pork casings (26-28 mm)
PORTION	Link to sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 2 days
PREPARE	Fry in a frying pan or roast on a grill

THURINGIAN BBQ SAUSAGE*(Fresh sausage type, coarse meat with binder, water added)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

50.00 %	Pork trimmings, lean, fresh	5.000 kg
30.00 %	Pork belly without skin, fresh	3.000 kg
15.00 %	Beef trimmings, lean	1.500 kg
5.00 %	Ice (potable water)	0.500 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
15.00 g	Common salt (refined)	150.00 g
1.50 g	Phosphate, plain (>pH 7.3)	15.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
50.00 g	Onions, fresh	500.00 g
2.00 g	White pepper, ground	20.00 g
0.30 g	Ginger, ground	3.00 g
0.30 g	Cardamom, ground	3.00 g
0.20 g	Nutmeg, ground	2.00 g

PROCESSING

GRIND	Beef trimmings and onions 3 mm
CHOP	Ground beef with ice and all additives Until a fine lean batter is achieved
CUT	Pork meat and belly in small pieces
MIX	Fresh pork meat, onions, ground beef, seasonings
GRIND	Meat/onion/seasonings mixture 5 mm
MIX	All ground materials and fine beef batter thoroughly
STUFF	Into natural sheep casings (22-24 mm)
PORTION	Link to sausages of desired size (60-100 g)
STORE	Below +4°C, shelf life < 2 days
PREPARE	Fry in a frying pan or roast on a grill

BEEFBURGER (traditional recipe, premium)**
(Fresh processed meat product, coarse mixture)

INGREDIENTS

Raw materials: (calculated for 5 kg batch)

100.00 % Lean beef meat, low connective tissue 5.000 kg

Extenders: ---

Additives:

(per kg of raw materials) (total for 5 kg)

12.00 g Common salt 60.00 g

Seasoning:

(per kg of raw materials) (total for 5 kg)

5.00 g Black pepper ground 25.00 g

PROCESSING

CUT Lean beef meat into small pieces
MIX lean beef meat, additives and seasoning
GRIND Mixture 3mm
SHAPE Into patties (50-100 g per patty) in paperlyne
PACK In P.E. bag and seal
STORE In freezer at -18°C
PREPARE Fry in shallow oil or grill on charcoal

** **CHICKEN BURGERS** see page 191, 202

LOW-COST BURGERS see page 201

JUICY BURGER (Beef/pork mixture, premium, Philippines)
(Fresh processed meat product, coarse mixture)

INGREDIENTS

Raw materials: (calculated for 5 kg batch)

40.00 %	Beef lean, ground	2.000 kg
45.00 %	Pork lean, ground	2.250 kg
10.00 %	Pork back fat	0.500 kg
5.00 %	Potable water	0.250 kg

Extenders: ---

Additives:

(per kg of raw materials) (total for 5 kg)

12.00 g	Common salt	60.00 g
2.00 g	Phosphate	15.00 g

Seasoning:

(per kg of raw materials) (total for 5 kg)

10.00 g	Sugar, refined	50.00 g
11.00 g	Garlic, chopped	55.00 g
5.00 g	Black pepper ground	25.00 g
1.50 g	Monosodium glutamate (MSG)	7.50 g
1.00 g	Celery powder	5.00 g
130.00 g	Onion, chopped	650.00 g
30.00 g	Wheat flour	150.00 g
2 pcs	Eggs, fresh	10 pcs

PROCESSING

CUT	Lean meat and pork back fat into small pieces
MIX	Lean meat, back fat, additives and seasoning
GRIND	Mixture 3mm
FORM	Into patties (50 g per patty) in paperlyne
PACK	In PE bag and seal
STORE	In freezer at -18°C
PREPARE	Fry in shallow oil or grill on charcoal

JUICY BURGER (Beef/pork mixture, extended, Philippines)
(Fresh processed meat product, coarse mixture)

INGREDIENTS

Raw materials: (calculated for 5 kg batch)

25.00 %	Beef lean, ground	1.250 kg
25.00 %	Pork lean, ground	1.250 kg
20.00 %	Pork back fat, ground	1.000 kg

Extenders:

(total for 5 kg)

8.00 %	TVP (textured vegetable protein)	0.400 kg
21.50 %	Water for hydration	1.075 kg
0.50 %	ISP (isolated soy protein)	0.025 kg

Additives:

(per kg of raw materials)

(total for 5 kg)

12.00 g	Common salt	60.00 g
2.00 g	Phosphate	10.00 g
50.00 g	Potable water	250.00 g

Seasonings:

(per kg of raw materials)

(total for 5 kg)

10.00 g	Sugar, refined	50.00 g
1.00 g	Celery powder	5.00 g
5.00 g	Black pepper ground	25.00 g
100.00 g	Onion, chopped	500.00 g
30.00 g	All purpose flour	150.00 g
10.00 g	Garlic, chopped	50.00 g
2 pcs	Eggs, fresh	10 pcs

PROCESSING

HYDRATE	TVP and ISP with potable water
CUT	Lean meat and pork back fat into small pieces
GRIND	Pork back fat and lean meat 3mm
MIX	Meat and fat with hydrated TVP/ISP, additives, seasonings
FORM	Into patties (50 g) in paperlyne
PACK	In P.E. bag and seal bags
STORE	In freezer at -18°C
PREPARE	Fry in shallow oil or grill on charcoal

CHICKEN NUGGETS / Asian small-scale product*(Fresh processed meat product, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 5 kg batch)

95.00 %	Chicken meat, boneless	4.750 kg
5.00 %	Chicken skin (from breast)	0.250 kg

Additives:

(per kg of raw materials)

(total for 5 kg)

12.00 g	Common salt	60.00 g
3.00 g	Phosphate	15.00 g
50.00 g	Potable water (chilled)	250.00 g

Seasonings:

(per kg of raw materials)

(total for 5 kg)

10.00 g	Sugar (refined)	50.00 g
20.00 g	Garlic fresh, chopped	100.00 g
6.00 g	White pepper, ground	30.00 g
1.00 g	Monosodium glutamate (MSG)	5.00 g

PROCESSING

GRIND	Chilled chicken skin 3mm Chilled chicken meat, 5 mm
MIX	Ground raw materials, additives and seasonings
MOULD	Mixture in a rectangular tray, 10-15 mm thick
FREEZE	At -7°C to facilitate cutting into nuggets
CUT	Into desired size (e.g. 20x30 mm)
ROLL	In breading or in bread crumbs
STORE	Packed and deep-frozen at -18°C
PREPARE	Deep-fry at +180°C until golden brown

RAW-FERMENTED SAUSAGES

CHORIZO / Medium-term ripened raw sausage

(Raw-fermented sausage type, coarse mixture)

INGREDIENTS

Raw materials: (calculated for 10 kg batch)

50.00 %	Pork meat without tendons, lean	5.000 kg
50.00 %	Pork belly without rind, fresh	5.000 kg

Extenders: ---

Additives:

(per kg of raw materials)		(total for 10 kg)
28.00 g	Common salt (refined)	280.00 g
0.50 g	Sugar	5.00 g
0.50 g	GdL (glucono-delta-lactone)	5.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
5.00 g	Paprika, sweet, red	50.00 g
1.50 g	Chilli, ground	15.00 g

PROCESSING

CUT	Meat and belly into small pieces, keep at -4°C
MIX	Raw materials, additives and seasonings
GRIND	Mixture 8 mm
STUFF	Into natural sheep casings (28-32 mm)
PORTION	Link into sausages of desired size (100-200 g)
RIPEN	For 7 days at +18-22°C (weight loss 25-30.0 %)
SMOKE	Cold smoke (<+22°C) for 6 hrs. on day 2/5 (weight loss 30-35 %)
STORE	In a dry and cool place (below + 25°C)

MUTTON SALAMI / Medium-term ripened raw sausage*(Raw-fermented sausage type, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

80.00 %	Mutton meat without tendons, fresh	8.000 kg
20.00 %	Beef fat, fresh	2.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
22.00 g	Nitrite curing salt	220.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
2.00 g	Black pepper, ground	20.00 g
1.00 g	White pepper corns	10.00 g
0.50 g	Cardamom, ground	5.00 g
1.00 g	Fresh garlic	10.00 g

PROCESSING

CUT	Meat and fat into small pieces and keep at -4°C
MIX	Frozen meat and fat pieces and seasonings
GRIND	Meat/seasonings mixture 5 mm
STUFF	Natural sheep or beef casings (28-34 mm)
PORTION	Link into sausages of desired size (60-100 g)
RIPEN	3-5 days at $+20^{\circ}\text{C}$
SMOKE	Cold smoke ($< +22^{\circ}\text{C}$) for 6 hrs. on day 2/5 (weight loss 30-35 %)
STORE	In a dry and cool place (below $+ 25^{\circ}\text{C}$)

SUMMER SAUSAGE / Quick-cured raw sausage*(Semi-dry, raw-fermented sausage type, coarse mixture)***Meat grinder use only****INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

30.00 %	Pork meat, lean	3.000 kg
30.00 %	Beef trimmings, lean	3.000 kg
20.00 %	Pork belly without skin	2.000 kg
20.00 %	Pork back fat	2.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
28.00 g	Nitrite curing salt	280.00 g
1.00 g	Starter cultures (e.g. Staphylococcus)	10.00 g
3.00 g	GdL (glucono-delta-lactone)	3.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
3.00 g	White pepper, ground	30.00 g
2.00 g	Mustard seeds	20.00 g
1.00 g	Coriander, ground	10.00 g
0.50 g	Pimento	5.00 g

PROCESSING

(meat grinder only)

CUT	Pork meat into small pieces and keep below -4°C Back fat into dices (10-20 mm), keep below -4°C
GRIND	Lean beef trimmings 3 mm
MIX	Raw materials, additives and seasonings
GRIND	Mixture 5 mm
STUFF	Beef middles (35-45 mm) Fibrous/collage casings (50-60 mm)
RIPEN	At $+24-26^{\circ}\text{C}$ for 4-7 days
SMOKE	Cold smoke ($+22^{\circ}\text{C}$) on days 2, 4 and 6 (weight loss approx. 25-30%)
KEEP	In a dry and cool place

CERVELAT SAUSAGE / Quick-cured raw sausage
(Semi-dry, raw-fermented sausage type, fine particles)
Meat grinder/ bowl cutter combined use

INGREDIENTS

Raw materials: (calculated for 10 kg batch)

40.00 %	Pork meat, lean	4.000 kg
30.00 %	Beef trimmings, lean	3.000 kg
30.00 %	Pork back fat	3.000 kg

Extenders: ---

Additives:

(per kg of raw materials)		(total for 10 kg)
28.00 g	Nitrite curing salt	280.00 g
1.00 g	Starter cultures (e.g. Staphylococcus)	10.00 g
3.00 g	GdL (glucono-delta-lactone)	3.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
3.00 g	White pepper, ground	30.00 g
1.00 g	Coriander, ground	10.00 g

PROCESSING

CUT	Pork meat into small pieces, keep below -12°C 50% beef meat into pieces, keep below -12°C Back fat into dices (10-20 mm), keep below -12°C
GRIND	Remaining lean beef 2 mm, keep chilled
CHOP	At high speed the frozen lean pork, beef, back fat including starter cultures and seasonings (until fine particle size is achieved)
ADD	At slow speed the ground beef trimmings and distribute thoroughly, now add the curing salt and continue chopping (final temperature $-4-6^{\circ}\text{C}$)
STUFF	Beef bungs or fibrous/collagen casings (60-75 mm)
RIPEN	At $< +24-26^{\circ}\text{C}$ for 4 days, at $+22^{\circ}\text{C}$ for 5 days
SMOKE	Cold smoke ($< +22^{\circ}\text{C}$) on days 2, 5 and 8 (weight loss approx. 30-35%)
KEEP	In a dry and cool place

SALAMI SAUSAGE / Long-term ripened raw sausage*(Raw-fermented sausage type, coarse mixture)***Meat grinder use only****INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

35.00 %	Pork meat, lean	3.500 kg
35.00 %	Beef trimmings, lean	3.500 kg
30.00 %	Pork back fat	3.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
28.00 g	Nitrite curing salt	280.00 g
1.00 g	Starter cultures (mixtures)	10.00 g
3.00 g	Sugar (lactose-glucose)	3.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
3.00 g	White pepper, ground	30.00 g
2.00 g	Mustard seeds	20.00 g
1.00 g	Coriander, ground	10.00 g
0.50 g	Pimento	5.00 g

PROCESSING

CUT	Pork meat into small pieces and keep below -4°C Back fat into dices (10-20 mm), keep below -4°C
GRIND	Lean beef trimmings 3 mm
MIX	Raw materials, additives and seasonings
GRIND	Mixture 5 mm
STUFF	Beef middles (35-45 mm) Fibrous/collage casings (55-75 mm)
PORTION	Link, tie/clip and hang (400-2000 g)
REDDEN	6 days at $+20-25^{\circ}\text{C}$ (lower temperature from day 4)
RIPEN	At $<+14^{\circ}\text{C}$ for 10 days
SMOKE	Cold smoke ($<+22^{\circ}\text{C}$) on days 2, 4 and 6 (weight loss 30-40%)
KEEP	In a dry and cool place

SALAMI SAUSAGE / Long-term ripened raw sausage*(Raw-fermented sausage type, coarse mixture)***Meat grinder / bowl cutter combined use****INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

35.00 %	Pork meat, lean	3.500 kg
35.00 %	Beef trimmings, lean	3.500 kg
30.00 %	Pork back fat	3.000 kg

Extenders: ---**Additives:**

(per kg of raw materials)		(total for 10 kg)
28.00 g	Nitrite curing salt	280.00 g
1.00 g	Starter cultures (mixtures)	10.00 g
3.00 g	Sugar (lactose-glucose)	3.00 g

Seasonings:

(per kg of raw materials)		(total for 10 kg)
3.00 g	White pepper, ground	30.00 g
2.00 g	Mustard seeds	20.00 g
1.00 g	Coriander, ground	10.00 g
0.50 g	Pimento	5.00 g

PROCESSING

CUT	Pork meat into small pieces and keep below -10°C Back fat into dices (20 mm), keep below -12°C
GRIND	Lean beef trimmings 3 mm, keep chilled (0°C)
CHOP	At medium speed the lean pork meat, back fat including starter cultures and seasonings (until fat displays desired particle size)
ADD	At slow speed the ground beef trimmings and distribute thoroughly, now add the curing salt and continue chopping (final temperature $-4^{\circ}/-6^{\circ}\text{C}$)
STUFF	Fibrous/collagen casings (55-75 mm)
REDDEN – RIPEN – SMOKE - STORE	

RAW-COOKED MEAT PRODUCTS

FRANKFURTERS (mixed beef/pork product)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for a 30 kg batch)

30.00 %	Pork meat trimmings, lean	9.000 kg
20.00 %	Beef meat trimmings, lean	6.000 kg
25.00 %	Fatty pork tissues	7.500 kg
25.00 %	Ice (drinking water)	7.500 kg

Additives:

(per kg raw materials)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate (pH >7.3)	90.00 g
0.30 g	Ascorbic acid	9.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
3.00 g	White pepper, ground	90.00 g
1.00 g	Nutmeg, ground	30.00 g
0.50 g	Cardamom, ground	15.00 g
0.20 g	Coriander, ground	6.00 g

PROCESSING

GRIND	Meats and fats separately 3 mm
CHILL	Meats and fats over night at < +4°C
CHOP	Ground meat, ice and additives for 10-15 rounds Add fats and seasonings and chop until +12°C
STUFF	Sheep casings (24/26 mm) or pig casings (26/28 mm)
LINK	To desired length and twist
SMOKE	At +65°C for 40 min.
COOK	In water or steam +76°C for > 30 min. (core temperature > +72°C for all products)
COOL	Under cold shower or in water until < +20°C
STORE	In chiller below +4°C, shelf life < 14 days

VIENNA SAUSAGES (premium quality, mixed beef/pork product)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for a 30 kg batch)

40.00 %	Pork meat trimmings, lean	12.000 kg
16.00 %	Beef meat trimmings, lean	4.800 kg
22.00 %	Fatty pork tissues	6.600 kg
22.00 %	Ice (drinking water)	6.600 kg

Extenders: ---

Additives:

(per kg raw materials)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate (pH >7.3)	90.00 g
0.30 g	Ascorbic acid	9.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
3.00 g	White pepper, ground	90.00 g
1.00 g	Nutmeg, ground	30.00 g
0.50 g	Cardamom, ground	15.00 g
0.20 g	Coriander, ground	6.00 g

PROCESSING

GRIND	Meats and fats separately 3 mm
CHILL	Meats and fats over night at < +4°C
CHOP	Ground meat, ice and additives for 10-15 rounds Add fats and seasonings and chop until +12°C
STUFF	Sheep casings (20/22 mm)
LINK	To desired length and twist
SMOKE	At +65°C for 40 min.
COOK	In water or steam +76°C for > 30 min. (core temperature > +72°C for all products)
COOL	Under cold shower or in water until < +20°C
STORE	In chiller below +4°C, shelf life < 14 days

CHICKEN VIENNAS (premium quality, pure poultry product)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for a 30 kg batch)

50.00 %	Chicken meat trimmings, lean	15.000 kg
10.00 %	Vegetable oil	3.000 kg
20.00 %	Chicken fat emulsion (1:6:6)	6.000 kg
20.00 %	Ice (drinking water)	6.000 kg

Extenders: ---

Additives:

(per kg raw materials and extenders)		(total for 30 kg)
10.00 g	Nitrite curing salt	300.00 g
2.00 g	Phosphate	60.00 g
0.10 g	Sodium erythorbate	3.00 g
1.00 g	Food colouring (liquid)	30.00 g

Seasonings:

(per kg raw materials and extenders)		(total for 30 kg)
2.00 g	White pepper, ground	60.00 g
0.30 g	Nutmeg, ground	9.00 g
0.60 g	Garlic powder	18.00 g

PROCESSING

GRIND	Meat trimmings 3 mm
EMULSIFY	Chicken skin/fats, chill emulsions at < 0°C
CHILL	Meat trimmings and vegetable oil over night
CHOP	Meats, ice, extenders and additives for 10-15 rounds Add fat emulsion and seasonings and chop until +12°C
STUFF	Into sheep or collagen casings, 20-22 mm and link
SMOKE	Dry for 30 min. at +45°C, smoke at +65°C for 30 min.
COOK	In water or steam at +75°C for 20 min.
COOL	under cold shower or in water, vacuum pack and chill
STORE	< +4 C, shelf life less than 10 days

* Part of the lean chicken meat is often replaced by other poultry meats, mostly turkey, to improve texture, colour and binding; subject to availability.

BEEF FRANKFURTERS (pure beef product)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for a 30 kg batch)

40.00 %	Beef meat trimmings, lean	12.000 kg
20.00 %	Beef meat trimming, fatty	6.000 kg
15.00 %	Vegetable oil	4.500 kg
25.00 %	Ice (drinking water)	7.500 kg

Extenders: ---

Additives:

(per kg raw materials)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate (pH >7.3)	90.00 g
0.30 g	Ascorbic acid	9.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
3.00 g	White pepper, ground	90.00 g
1.00 g	Nutmeg, ground	30.00 g
0.50 g	Cardamom, ground	15.00 g
0.20 g	Coriander, ground	6.00 g

PROCESSING

GRIND	Beef meats 3 mm
CHILL	Meats and vegetable oil over night at < +4°C
CHOP	Ground meats, ice and additives for 25 rounds Add vegetable oil and seasonings, chop until +12°C
STUFF	In sheep or collagen casings, 24/26 mm
LINK	To desired length and twist
SMOKE	At +65°C for 40 min.
COOK	In water or steam +76°C for > 30 min. (core temperature > +72°C)
COOL	Under cold shower or in water until < +20°C
STORE	In chiller below +4°C, shelf life < 14 days

LYONER / Fine ham sausage*(Raw-cooked sausage type, finely chopped batter)***INGREDIENTS****Raw materials:** (calculated for 30 kg medium batch)

40.00 %	Pork meat trimmings, lean	12.000 kg
15.00 %	Beef meat trimmings, lean	4.500 kg
22.50 %	Fatty pork tissues	6.750 kg
22.50 %	Ice (potable water)	6.750 kg

Extenders: ---**Additives:**

(per kg raw materials)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate (pH >7.3)	90.00 g
0.30 g	Ascorbic acid	9.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
2.00 g	White pepper, ground	60.00 g
0.50 g	Nutmeg, ground	15.00 g
0.50 g	Mace, ground	15.00 g
0.30 g	Cardamom, ground	9.00 g

PROCESSING

GRIND	Meats and fats separately 3 mm
CHILL	Meats and fats over night at < +4°C
CHOP	Ground meat, ice and additives for 10-15 rounds Add fats and seasonings and chop until +12°C
STUFF	<u>Plastic casings</u> , 60 mm or <u>Cattle rounds</u> , 40 mm
SMOKE	N/A at +65°C for 40 min.
COOK	At +76°C for 75 min. at +76°C for 40 min. (core temperature > +72°C for both casing formats)
COOL	Under cold shower or in water until < +20°C
STORE	In chiller below +4°C, shelf life < 14 days

COARSE HAM SAUSAGE*(Raw-cooked sausage type, finely chopped batter with coarse meats)***INGREDIENTS****Raw materials:** (calculated for 30 kg batch)

50.00 %	Lyoner sausage mix (raw batter)	15.000 kg
40.00 %	Pork meat, lean, no tendons	12.000 kg
10.00 %	Pork belly without skin (50/50)	3.000 kg

Extenders: ---**Additives:**

(per kg pork meat and belly – 15 kg)		(total for 15 kg)
18.00 g	Nitrite curing salt	270.00 g
3.00 g	Phosphate	45.00 g

Seasonings:

(per kg pork meat and belly – 15 kg)		(total for 15 kg)
2.00 g	White pepper, ground	30.00 g
0.50 g	Mace, ground	7.50 g
0.50 g	Coriander, ground	7.50 g
0.50 g	Ginger, ground	7.50 g

PROCESSING

CUT	pork meat and belly in small pieces	
MIX	pork meat, belly, salt and spices	
GRIND	Mixture 8-13 mm and store over night in cold room	
MIX	Lyoner batter and ground mixture	
STUFF	Plastic casings, 60 mm	or cattle rounds, 40 mm
SMOKE	N/A	at +65°C for 60 min.
COOK	At +75°C for 75 min.	at +76°C for 40 min.
	(core temperature > +72°C for both casing formats)	
COOL	Under cold shower or in water, drain and air-dry	
STORE	In chiller below +4°C, shelf life < 14 days	

WHITE SAUSAGE / Veal Sausage (Bavaria)*(Raw-cooked sausage type, finely chopped batter)***INGREDIENTS****Raw materials:** (calculated for 30 kg batch)

30.00 %	Veal trimmings	9.000 kg
20.00 %	Pork trimmings	6.000 kg
25.00 %	Pork fat, soft fatty tissue	7.500 kg
25.00 %	Ice (drinking water)	7.500 kg

Extenders: ---**Additives:**

(per kg raw materials)		(total for 30 kg)
18.00 g	Common salt	540.00 g
3.00 g	Phosphate	90.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
1.00 g	White pepper, ground	30.00 g
0.50 g	Ginger, ground	15.00 g
0.50 g	Mace, ground	15.00 g
0.50 g	Lemon skin	15.00 g
1.00 g	Parsley leaves, fresh	30.00 g
3 pieces	Onions, fresh	

PROCESSING

CUT	Meats and fatty tissues in small pieces
CHILL	Meats and fats over night at < +4°C
GRIND	Meats and fats separately 3 mm
CHOP	Ground meat, ice and ingredients for 10 rounds. Add fats and seasonings and chop until +12°C
STUFF	In hog casings 26/28 mm
COOK	In water at +74°C for 40 min.
COOL	Under cold shower or in cold water
PREPARE	Traditionally eaten immediately after production Heated in simmering water
STORE	Optional: In chiller below +4°C, shelf life < 5 days

KRAKOW SAUSAGE (Polish traditional product)**(Raw-cooked sausage type, finely chopped batter with coarse meats)***INGREDIENTS****Raw materials:** (calculated for 30 kg batch)

10.00 %	Beef trimmings, high collagen content	3.000 kg
10.00 %	Pork trimmings, high collagen content	3.000 kg
10.00 %	Ice (potable water)	3.000 kg
50.00 %	Pork meat, lean, no tendons	15.000 kg
20.00 %	Pork belly without skin	6.000 kg

Extenders: ---**Additives:**

(per kg raw materials)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate	90.00 g

Seasonings:

(per kg pork meat and belly – 15 kg)		(total for 30 kg)
2.00 g	Black pepper, ground	60.00 g
0.20 g	Cardamom, ground	6.00 g
0.50 g	Mace, ground	15.00 g

PROCESSING

CUT	Lean pork meat and belly in small pieces
MIX	Lean meat, belly, remaining additives, seasonings
GRIND	Mixture 13 mm and store over night in cold room
GRIND	Beef and pork trimmings 3 mm
CHOP	Ground trimmings with ice, and 30% additives In bowl cutter until a fine lean batter is achieved
MIX	Fine lean batter and chilled ground mixture
STUFF	Into fibrous or collagen casings 60-75 mm
SMOKE	Hot at +65°C for 60 min.
COOK	At +75°C for 75-90 min. (core temp. > +72°C)
COOL	Under cold shower or in water, drain and air-dry
SMOKE	Cold at +18-22°C the following day
STORE	In cold room below +12°C

* Due to continuing moisture loss, the product can become semi-dry and display a reasonable shelf-life at cooler temperatures

BUFFALO SAUSAGE (non-pork product)*(Raw-cooked sausage type, finely chopped batter with coarse meats)***INGREDIENTS****Raw materials:** (calculated for 30 kg batch)

45.00 %	Lean buffalo meat	13.500 kg
35.00 %	Buffalo trimmings (30 % fat)	10.500 kg
10.00 %	Buffalo brisket fat or beef hump fat	3.000 kg
10.00 %	Ice (drinking water)	3.000 kg

Extenders: ---**Additives:**

(per kg of material)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate	90.00 g
0.30 g	Ascorbic Acid	9.00 g

Seasonings:

(per kg of material)		(total for 30 kg)
3.0 g	White pepper, ground	30.00 g
1.0 g	Nutmeg, ground	10.00 g
0.5 g	Coriander, ground	5.00 g
0.5 g	Chilli, ground	5.00 g
2.0 g	Garlic, fresh	20.00 g

PROCESSING

GRIND	Lean buffalo meat 3 mm, trimmings 5 mm, fats 13 mm Store over night in cold room
CHOP	Lean buffalo meat, ice, additives, spices until fine batter Add fat and distribute in slow gear evenly Add trimmings and distribute in slow gear evenly
STUFF	Into <u>plastic casings</u> into <u>tin plate cans</u> Diameter 75 mm size 73/110
COOK	At +75°C for 90 min. at +121°C for 120 min. (core temp +72°C) (core temp +114°C, F-value 12)
COOL	Under cold shower or in cold water, drain and air-dry
STORE	In cold rooms below +4°C below +40°C Shelf life < 14 days shelf life 1 year as fully sterilized cans

MORTADELLA (with slaughter by-products, Italy)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for 30 kg batch)

30.00 %	Beef trimmings	9.000 kg
20.00 %	Pork/beef (gullet, skirt, cheeks)	6.000 kg
15.00 %	Fatty tissues	4.500 kg
10.00 %	Soft by-products (lung, spleen, etc.)	3.000 kg
15.00 %	Ice (potable water)	4.500 kg

Extenders: (calculated for 30 kg batch)

10.00 %	Wheat flour	3.000 kg
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Additives:

(per kg raw materials)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate	90.00 g
0.30 g	Ascorbic acid	9.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
2.50 g	White pepper, ground	75.00 g
1.00 g	Nutmeg, ground	30.00 g
0.50 g	Cardamom, ground	15.00 g
0.50 g	Coriander, ground	15.00 g
0.20 g	Cloves, ground	6.00 g
0.20 g	Fresh garlic	6.00 g

PROCESSING*

CUT	Meat, fats and by-products in small pieces
GRIND	Meat, fats and by-products separately 3 mm
CHOP	Meat, by-products, ice and additives for 10 to 15 rounds Add fatty tissue, seasonings and chop until +12°C
STUFF	Into plastic casings diameter 120-240 mm
COOK	At +80°C for > 150-280 min. (core temp. > +72°C)
COOL	Under cold shower or in cold water, drain and air-dry
STORE	In cold room below +4°C, shelf life < 14 days

* Sometimes small back fat cubes (5 mm) and pistachio are added

BEEF FRANKFURTERS (moderately extended)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for a 30 kg batch)

33.00 %	Beef meat trimmings, lean	9.900 kg
20.00 %	Beef trimmings, fatty	6.000 kg
20.00 %	Vegetable oil	6.000 kg
25.00 %	Ice (drinking water)	7.500 kg

Extenders: (calculated for a 30 kg batch)

2.00 %	Wheat flour	0.600 kg
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Additives:

(per kg raw materials and extenders)		(total for 30 kg)
18.00 g	Nitrite curing salt	540.00 g
3.00 g	Phosphate (pH >7.3)	90.00 g
0.30 g	Ascorbic acid	9.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
3.00 g	White pepper, ground	90.00 g
1.00 g	Nutmeg, ground	30.00 g
0.50 g	Cardamom, ground	15.00 g
0.20 g	Coriander, ground	6.00 g
0.50 g	Garlic, fresh	15.00 g

PROCESSING

GRIND	Meat and fatty trimmings separately 3 mm
CHILL	Meats, fats and vegetable oil over night at < +4°C
CHOP	Ground meats, ice and additives for 15-20 rounds Add slowly vegetable oil, seasonings; chop until +12°C
STUFF	Sheep or collagen casings, 20-24 mm
LINK	To desired length and twist (60-100 g)
SMOKE	At +65°C for 40 min.
COOK	In water or steam +76°C for > 30 min. (core temperature > +72°C)
COOL	Under cold shower or in water until < +20°C
STORE	In chiller below +4°C, shelf life < 14 days

BEEF HOTDOG (substantially extended)*(Raw-cooked sausage type, finely chopped batter)* (see also page 204)**INGREDIENTS****Raw materials:** (calculated for a 30 kg batch)

35.00 %	Beef meat trimmings, lean	10.500 kg
14.00 %	Fat emulsion (1:6:6)	4.200 kg
20.00 %	Ice (drinking water)	6.000 kg

Extenders: (calculated for a 30 kg batch)

18.00 %	Water for hydration of TVP (1:3)	5.400 kg
6.00 %	TVP (Textured Vegetable Protein)	1.800 kg
0.50 %	ISP (Isolated Soya Protein)	0.150 kg
5.00 %	Potato starch	1.500 kg
1.50 %	Skimmed milk	0.450 kg

Additives:

(per kg raw materials and extenders)		(total for 30 kg)
10.00 g	Nitrite curing salt	300.00 g
2.00 g	Phosphate	60.00 g
2.00 g	Carrageenan	60.00 g
0.10 g	Sodium erythorbate	3.00 g

Seasonings:

(per kg raw materials and extenders)		(total for 30 kg)
2.00 g	White pepper, ground	60.00 g
0.30 g	Nutmeg, ground	9.00 g
0.60 g	Garlic powder	18.00 g
0.35 g	Paprika	10.50 g
0.35 g	Mustard seeds, ground	10.50 g

PROCESSING

GRIND	Meat trimmings 3 mm and chill over night
EMULSIFY	ISP, water and vegetable oil, chill emulsion at < 0°C
HYDRATE	TVP by mixing with cold water 1:3
CHOP	Meats, ice, extenders and additives for 10-15 rounds Add fat emulsion and seasonings and chop until +12°C
STUFF	Into peeling casings diameter 20-22 mm and link
SMOKE	Dry for 30 min. at +45°C, smoke at +65°C for 30 min.
COOK	In water or steam at +75°C for 20 min.
COOL	under cold shower or in water, vacuum pack and chill
STORE	<+4 C, shelf life less than 14 days

CHICKEN HOTDOG (substantially extended)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for 30 kg batch)

20.00 %	Chicken meat trimmings, lean	6.000 kg
20.00 %	Chicken MDM	6.000 kg
20.00 %	Chicken fat emulsion (1:6:6)	6.000 kg
18.00 %	Ice (drinking water)	5.400 kg

Extenders:

12.00 %	Water for hydration of TVP (1:3)	3.600 kg
4.00 %	TVP (Textured Vegetable Protein)	1.200 kg
0.50 %	ISP (Isolated Soya Protein)	0.150 kg
4.00 %	Potato starch	1.200 kg
1.50 %	Skimmed milk	0.450 kg

Additives:

(per kg raw materials and extenders)		(total for 30 kg)
10.00 g	Nitrite curing salt	300.00 g
2.00 g	Phosphate	60.00 g
0.10 g	Sodium erythorbate	3.00 g
1.00 g	Food colouring (liquid)	30.00 g

Seasonings:

(per kg raw materials and extenders)		(total for 30 kg)
2.00 g	White pepper, ground	60.00 g
0.30 g	Nutmeg, ground	9.00 g
0.60 g	Garlic powder	18.00 g

PROCESSING

GRIND	Meat trimmings 3 mm and chill over night
EMULSIFY	Vegetable oil and chicken fats, chill emulsions at < 0°C
HYDRATE	TVP by mixing with cold water 1:3
CHOP	Meats, ice, extenders and additives for 10-15 rounds Add fat emulsion and seasonings and chop until +12°C
STUFF	Into peeling casings diameter 20-22 mm and link
SMOKE	Dry for 30 min. at +45°C, smoke at +65°C for 30 min.
COOK	In water or steam at +75°C for 20 min.
COOL	Under cold shower or in water, vacuum pack and chill
STORE	<4°C, SHELF LIFE LESS THAN 10 DAYS

BREAKFAST SAUSAGE (moderately extended)
(Raw-cooked sausage type, finely chopped batter)

INGREDIENTS

Raw materials: (calculated for 30 kg batch)

30.00 %	Beef meat trimmings, lean	9.000 kg
20.00 %	Pork meat trimmings, lean	6.000 kg
20.00 %	Fatty pork tissues	6.000 kg
18.00 %	Ice (potable water)	5.400 kg

Extenders:

6.00 %	Wheat flour	1.800 kg
4.00 %	Rusk (baked and crushed flour)	1.200 kg
2.00 %	Corn starch	0.600 kg

Additives:

(per kg raw materials)		(total for 30 kg)
16.0 g	Common salt	480.00 g
3.0 g	Phosphate	90.00 g
0.3 g	Ascorbic acid	9.00 g
0.5 g	MSG (mono sodium glutamate)	15.00 g

Seasonings:

(per kg raw materials)		(total for 30 kg)
2.0 g	White pepper, ground	60.00 g
0.3 g	Nutmeg, ground	9.00 g
0.3 g	Mace, ground	9.00 g
0.2 g	Coriander, ground	6.00 g
0.2 g	Ginger, ground	6.00 g

PROCESSING

CUT	Meat trimmings and fatty tissues in small pieces
CHILL	Meat trimmings and fats over night
GRIND	Meat trimmings and fats separately 3 mm
CHOP	Meat mince, fats, ice, spices and additives to +12°C
STUFF	Into collagen casings 26-28 mm, link 50 g
PACK	10-20 pieces (0.5-1.0 kg) in plastic pouches
STORE	In deep-freezer below -18°C, shelf life 3 to 6 months
	Stored raw frozen, heat-treated only prior to consumption

MEAT LOAVES

The common formulations for raw-cooked sausages can be used in principle for the fabrication of product mixes for meat loaves. There are meat loaves entirely composed of finely chopped batter and varieties consisting of fine batter mixed with coarse meat materials (usually ground 5-12 mm). Meat loaves are subject to intensive heat treatment when they are baked in ovens at +150°C, resulting in some weight loss (water evaporation). Usually the salt content is slightly reduced (from 18g to 16g calculated per kg of total raw materials).

Common recipes used for the fabrication of meat loaves are **frankfurters** (page 400) and **coarse ham sausage** (page 405), with the above mentioned adjustment on salt content.

MEAT BALLS

Raw-cooked meat mixes are used for the material, from which meat balls are shaped. These mixes are mainly fabricated without curing substances but with common salt, as for the majority of such products a grey colour is required. Formulations usually have high contents of lean meat (fat and water contents significantly reduced) to make these products firm-elastic. The salt content is reduced to 10-12g per kilo and often herbs are added.

Especially in Asia, there are several varieties of low-cost meat balls on the market. These meat balls are used as street food and in fast food outlets. One common formulation is shown below:

Raw materials:	(calculated for 10 kg batch)	
40.00 %	Pork meat trimmings, lean	4.000 kg
20.00 %	TVP (re-hydrated 1:3)	2.000 kg
10.00 %	Wheat flour	1.000 kg
10.00 %	Ice (potable water)	1.000 kg
15.00 %	Fatty pork tissues	1.500 kg
5.00 %	Potato or corn starch	0.500 kg
Additives and spices:	(per kg raw materials)	
10.0 g	Common salt	
2.0 g	Phosphate	
2.0 g	White pepper, ground	60.00 g
0.2 g	Coriander, ground	6.00 g
0.2 g	Ginger, ground	6.00 g

PRECOOKED-COOKED PRODUCTS

CORNER BEEF (traditional method, South America)
(Precooked-cooked meat product, coarse mixture)

The described procedure is a **small-scale processing** method.
Industrial processing method see page 169.

INGREDIENTS

Raw materials: (calculated for 10 kg batch)

80.00 %	Beef meat pieces, lean	8.000 kg
20.00 %	Beef meat trimmings	2.000 kg

Curing brine (10 litres):

(per litre brine)		(total for 10 kg)
22.00 g	Nitrite curing salt	220.00 g
2.00 g	Sugar	20.00 g

PROCESSING

CUT	Beef meat in uniform big stripes
CURE	Meat for 4 days in curing brine at +10°C
COOK	Beef meat stripes at +82°C *
CHECK	Meat for tendons, remove if necessary
GRIND	Cooked meat through kidney plate, reverse knife
STUFF	Into typical cans (compact properly) and seal
COOK	Sterilise cans to F-value 12-14
COOL	On air or in water
STORE	at ambient temperature

* Cooking loss around 30-35 %, often small layer of cooked fats is added on top.

CORNERED BEEF (premium quality, spiced variety, Philippines)*(Precooked-cooked meat product, coarse mixture)*

Similar variations are common also on the Pacific islands. The corned beef is prepared with onions, garlic and often potato pieces and consumed hot together with cooked/steamed rice.

INGREDIENTS**Raw Materials:** (calculated for 10 kg batch)

50.00 %	Beef meat and brisket)	5.000 kg
50.00 %	Buffalo meat trimmings, lean	5.000 kg

Curing brine: (2.500 kg brine, 10% salt solution)

88.86 %	Potable water	2.224.00 g
10.00 %	Nitrite curing salt	250.00 g
1.00 %	Sugar, refined	25.00 g
1.50 %	Phosphate (soluble)	37.50 g
0.04 %	Sodium erythorbate	1.00 g

Seasonings:

(per kg raw materials)		(total for 10 kg)
1.50 g	Ground black pepper	15.00 g
2.00 g	Chopped garlic, fresh	20.00 g
0.05 g	Bay leaf	0.50 g
3.00 g	Oregano powder	30.00 g

PROCESSING

CUT	Fresh/ chilled meats into 50 mm cubes
BRINE	Mix cold water (+4°C) with <i>ingredients</i> , start with phosphate (soluble), thereafter nitrite curing salt, thereafter sugar, sodium erythorbate (see page 180)
CURE	Meat in a clean container submerged in brine at +4 for 1 day
WASH	Cured meat once with potable water
COOK	Meat with seasonings in pressure cooker for 1 hour
FLAKE	Meat pieces and remix with broth (7:3)
STUFF	Into cans and sterilize at +110°C to F-value 12
STORE	At ambient temperature

CORNE D BEEF (substantially extended, spicy, Philippines)
(Precooked-cooked meat product, coarse mixture) (see also page 212)

INGREDIENTS

Raw Materials: (calculated for 10 kg batch)

25.00 %	Beef meat and brisket)	2.500 kg
50.00 %	Buffalo meat trimmings, lean	5.000 kg

Extenders: (calculated for 10 kg batch)

10.00 %	Pork skin	1.000 kg
10.00 %	Potable water (for re-hydration)	1.000 kg
5.00 %	TVP (textured vegetable protein)	0.500 kg
0.50 %	Carrageenan	0.050 kg

Curing brine: (2.500 kg brine, 10% salt solution)

88.86 %	Potable water	2.224.00 g
10.00 %	Nitrite curing salt	250.00 g
5.00 %	Sugar, refined	125.00 g
0.10 %	Sodium erythorbate	2.50 g

Seasonings:

(per kg raw materials)		(total for 10 kg)
2.00 g	Ground black pepper	20.00 g
2.00 g	Chopped garlic, fresh	20.00 g
3.00 g	Oregano powder	30.00 g
1.00 g	Ginger, ground	10.00 g
1.00 g	MSG (mono sodium glutamate)	10.00 g

PROCESSING

CUT	Fresh/ chilled meats into 50 mm cubes
BRINE	Mix brine components, start with phosphate (soluble), nitrite curing salt, sugar, sodium erythorbate
CURE	Meat in a clean container submerged in brine at +4°C for 1 day
RE-HYDRATE	TVP with potable water allocation
COOK	Meat, pork skin with seasonings for 1 hour
FLAKE	Meat, grind pork skin, remix with broth (7:3)
STUFF	Into plastic bags (250, 500 g) and seal
STORE	In deep-freezer, cook prior to consumption

FINE LIVER SAUSAGE / LIVER PATE*(Precooked-cooked sausage type, finely chopped batter)***INGREDIENTS****Raw materials:** (calculated for 30 kg batch)

35.00 %	Pork liver, raw	10.500 kg
50.00 %	Pork belly, pre-cooked (fresh weight 19.5 kg, cooking loss 4.500 kg)	15.000 kg
15.00 %	Meat soup ("broth") (compensation for cooking loss)	4.500 kg

Extenders: ---**Additives:**

(per kg materials)		(total for 30 kg)
15.00 g	Nitrite curing salt	450.00 g

Seasonings:

(per kg materials)		(total for 30 kg)
2.00 g	White pepper, ground	60.00 g
0.50 g	Ginger, ground	15.00 g
0.30 g	Cardamom, ground	9.00 g
0.30 g	Mace, ground	9.00 g
0.50 g	Vanilla sugar	15.00 g
1.00 g	Honey	30.00 g
30.00 g	Onions, slightly fried in lard	900.00 g

PROCESSING

CHOP	Fresh, chilled pork liver with nitrite curing salt at high speed until fine and creamy texture is achieved (bubbles)
CHILL	Chopped liver over night at < +4°C
PRE-COOK	Pork belly at +85°C, grind 13 mm
CHOP	Hot ground pork belly, onions and hot broth at high speed
ADD	Below +45°C add cold cured liver, spices and honey Complete chopping until +24°C
STUFF	Into plastic casings, diameter 60 mm
COOK	At +82°C for 75 min. to a core temperature > +72°C
COOL	Under cold shower or in cold water, drain and air-dry
STORE	In cold room below +4°C, shelf life < 14 days

COARSE LIVER SAUSAGE*(Precooked-cooked sausage type, coarse materials)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

15.00 %	Pork liver and kidneys, raw	1.500 kg
35.00 %	Meat and pork belly, pre-cooked	3.500 kg
15.00 %	Fatty tissues, pre-cooked	1.500 kg
15.00 %	Pig head meat, pre-cooked	1.500 kg
10.00 %	Meat soup (broth) (compensation for cooking loss)	1.000 kg

Extenders:

5.00 %	Wheat flour	0.500 kg
5.00 %	Bread crumbs (old bread or bread rolls)	0,500 kg

Additives:

(per kg materials)		(total for 10 kg)
16.00 g	Common salt (refined)	160.00 g

Seasonings:

(per kg materials)		(total for 10 kg)
50.00 g	Onions, slightly fried in lard	500.00 g
2.00 g	White pepper, ground	20.00 g
1.50 g	Marjoram	15.00 g
0.30 g	Ginger, ground	3.00 g
0.30 g	Cardamom, ground	3.00 g
0.20 g	Pimento (allspice), ground	2.00 g

PROCESSING

PRE-COOK	Meat trimmings, fatty tissues, pig heads
DE-BONE	Pig heads (beware of teeth, hard tissue)
MIX	Cooked materials, fresh liver, seasoning and additives
GRIND	Mixed materials 3 mm, mix again
STUFF	Into hog casings 26-30 mm, caps, middles
COOK	At +84°C to a core temperature > +72°C
COOL	Under cold shower or in cold water, drain and air-dry
SMOKE	Cold smoke < +20°C over night
STORE	In chiller below +4°C, shelf life < 14 days

BLOOD SAUSAGE / Central European product*(Precooked-cooked sausage type, coarse mixture)***INGREDIENTS****Raw materials:** (calculated for 10 kg batch)

20.00 %	Pig blood, raw	2.000 kg
25.00 %	Pork head-meat, pre-cooked	2.500 kg
25.00 %	Pork belly, pre-cooked	2.500 kg
20.00 %	Pork skin, pre-cooked	2.000 kg
5.00 %	Meat soup (broth)	0.500 kg
5.00 %	Onions, raw	0.500 kg

Extenders: ---**Additives:**

(per kg materials)		(total for 10 kg)
16.00 g	Nitrite curing salt	160.00 g

Seasonings:

(per kg materials)		(total for 10 kg)
2.50 g	White pepper, ground	25.00 g
1.00 g	Cloves, ground	10.00 g
0.70 g	Marjoram	7.00 g
0.50 g	Pimento (allspice), ground	5.00 g
0.30 g	Nutmeg, ground	3.00 g

PROCESSING

COOK	Pig heads, pork skin and pork belly
DE-BONE	Cooked pig heads (beware of teeth)
CUT	Pig head material and belly into dices or stripes
GRIND	Cooked hot pork skin, onions and broth 3 mm
MIX	a) fat and meat dices with salt and spices b) spiced dices with ground pork skin and add blood
STUFF	Into pork intestines of desired size
COOK	At +82°C to a core temperature of +75°C
COOL	On air and transfer to cold room for 24 hours
SMOKE	Cold smoke at < +22°C over night
STORE	In cold room at < +4°C, shelf life < 21 days

BLODKORV/ Extended Blood Sausage (Sweden)
(Precooked-cooked sausage type, coarse mixture)

INGREDIENTS

Raw materials: (calculated for 10 kg batch)

35.00 %	Pig blood, raw	3.500 kg
10.00 %	Pork lard	1.000 kg
10.00 %	Pork backfat, blanched	1.000 kg
10.00 %	Meat soup (broth)	1.000 kg

Extenders: (calculated for 10 kg batch)

25.00 %	Wheat flour	2.500 kg
10.00 %	Sugar	1.000 kg

Additives:

(per kg materials)		(total for 10 kg)
16.00 g	Common salt	160.00 g

Seasonings:

(per kg materials)		(total for 10 kg)
1.00 g	Cloves, ground	10.00 g
1.00 g	Cinnamon	10.00 g
1.00 g	Raisins	10.00 g

PROCESSING

MIX	Blood, sugar, salt and seasonings
CUT	Pork back fat into dices 5-8 mm
BLANCH	Pork back fat dices (scalding)
MIX	Wheat flour, lard, dices into heated meat soup Add the blood mix also
STUFF	Into medium size beef middles
COOK	At +85°C to a core temperature of +75°C
COOL	On air and transfer to cold room for 24 hours
SMOKE	Cold smoke at < +22°C over night and air-dry
STORE	In cold room at < +4°C

CURED MEAT CUTS

COOKED HAM / Entire muscle pieces formed together

Raw materials:

20.000 kg Pork topsides (meat piece from hind leg),
all connective tissue and fats removed from surface,
pH-value 5.7 or higher.

Brine composition:

7.000 kg Potable water
1.800 kg Crushed ice
1.200 kg Nitrite curing salt
0.200 kg Phosphate (soluble)
0.100 kg Sugar
0.100 kg Carrageenan
0.020 kg Sodium ascorbate

PROCESSING:

Meat is chilled (+4°C) prior to brine injection

Brine is prepared and chilled (supported by adding of crushed ice)

Without tumbler:

Inject 20% curing brine in the meat (based on fresh meat weight)

Submerge injected meat pieces in remaining brine

Keep in chiller for 48 hours

With tumbler:

Inject 20% curing brine in the meat (based on fresh meat weight)

Transfer injected meat pieces to tumbler

Tumble under refrigeration for 12 hours

5-8 rpm, 5 minutes rotation / 20 minutes resting, +2°C

Transfer meat pieces into ham moulds and apply firm pressure with cover

Allow for resting phase of 5 hours in chiller

Cook at +75°C to core temperature of +70°C (use Delta-t cooking if possible)

Cool under running water, transfer to chiller over night

Remove hams from ham moulds and vacuum-pack final product

RAW FERMENTED HAMS

Production principles see page 172

PORK BACON**Raw materials:**

20.000 kg Pork belly (meat/fat ratio 60/40)
Rib bones and soft bones are removed
Skin left on or also removed

Brine composition:

8.800 kg Ice water
1.200 kg Nitrite curing salt
0.200 kg Phosphate (soluble)
0.100 kg Sugar
0.020 kg Sodium ascorbate

PROCESSING:

Belly is trimmed and chilled (+4°C) prior to brine injection
Brine is prepared and chilled
20% curing brine are injected in the meat (based on fresh meat weight)
Injected bellies are submerged in remaining brine
Keep in chiller for 36-48 hours
Bellies are hung and hot-smoked
After hot-smoking, cool down at ambient temperature and transfer to chiller over night
Slice 2-4 mm and vacuum-pack

BEEF BACON**Raw materials:**

20.000 kg Beef silverside tip or brisket (meat 60-80%)
Bones and soft bones are removed
10 mm layer of body fat is left on silverside tip

Brine composition:

8.800 kg Ice water
1.200 kg Nitrite curing salt
0.200 kg Phosphate (soluble)
0.100 kg Sugar
0.020 kg Sodium ascorbate

PROCESSING:

See "pork bacon" above.

INGIGENOUS MEAT PRODUCTS

LUP-CHEONG / Chinese dry pork sausage

(Dried sausage type, coarse mixture) (see also page 214)

INGREDIENTS

Raw materials: (calculated for 10 kg batch)

60.00 %	Lean pork meat (90/10)	6.000 kg
40.00 %	Pork belly without skin (60/40)	4.000 kg

Extenders: ---

Additives:

(per kg raw materials)		(total for 10 kg)
15.00 g	Common salt (refined)	150.00 g
15.00 g	Sugar (saccharose)	150.00 g

Seasonings:

(per kg raw materials)		(total for 10 kg)
10.00 g	Soy sauce	100.00 g
2.00 g	Rice wine	20.00 g
1.00 g	Ginger, ground	10.00 g
0.50 g	Cinnamon, ground	5.00 g

PROCESSING

CUT	Meat and belly into small pieces, keep at -2°C
MIX	Raw materials, additives and seasonings
GRIND	Mixture 5 mm
STUFF	Natural pig casings (26 mm)
PORTION	Link into sausages of desired size (60-100 g)
DRY (SMOKE)	$+60^{\circ}\text{C}$ for 24-48 hrs., another 48 hours $+45-50^{\circ}\text{C}$
KEEP	In a dry and cool place (if possible vacuum packed)

NAEM (also Nham) / Fermented Pork Product (SE-Asia)
(Fermented sausage type, coarse mixture) (see also page 217)

INGREDIENTS

Raw Materials: (calculated for 10 kg batch)		
60.00 %	Pork meat, lean	6.000 kg
20.00 %	Pork skin	2.000 kg
Extenders: (calculated for 10 kg batch)		
20.00 %	Rice, medium quality, cooked	2.000 kg
Additives:		
(per kg raw materials)		(total for 10 kg)
23.00 g	Nitrite curing salt	230.00 g
1.00 g	MSG (mono sodium glutamate)	10.00 g
Seasonings:		
(per kg raw materials)		(total for 10 kg)
15.00 g	Chilli, fresh	150.00 g
2.00 g	Sugar	20.00 g
80.00 g	Fresh garlic	800.00 g

PROCESSING

PRECOOK	Rice (cook in water or steam) Pork skin in boiling water
CUT	Lean pork meat in smaller pieces Cooked pork skin in small stripes
GRIND	Pork meat, seasonings and garlic 3 mm
MIX	Mixture with cooked rice and pork skin
PORTION	Wrap small quantities in banana leaves (traditional) or stuff in perforated plastic casings (35 mm)
FERMENT	At room temperature (+25-30°C) for 2-4 days
STORE	Under refrigeration, shelf-life 2 weeks
CONSUME	As snack or use as ingredient to meals

ISAAN SAUSAGE / Herb Sausage (Thailand, recipe 1)*(Quick-cured sausage type, coarse mixture)***INGREDIENTS****Raw Materials:** (calculated for 10 kg batch)

80.00 %	Pork belly without skin, fresh	8.000 kg
10.00 %	Potable water	1.000 kg

Extenders:

10.00 %	Rice, medium quality	1.000 kg
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Additives:

(per kg raw materials)		(total for 10 kg)
12.00 g	Common salt	120.00 g
2.00 g	Erythorbate	20.00 g

Seasonings:

(per kg raw materials)		(total for 10 kg)
6.00 g	White pepper, ground	60.00 g
1.00 g	Sugar	10.00 g
20.00 g	Fresh garlic	200.00 g
1.00 g	MSG (mono sodium glutamate)	10.00 g

PROCESSING

CUT	Pork meat in small pieces
SOAK	Rice in water
GRIND	Pork meat, seasonings and garlic 5 mm
MIX	Pork meat, garlic, seasoning and rice
STUFF	Into natural pork casings (26-28mm)
CURE	At room temperature (+37°C) for 2 days
STORE	Under refrigeration, shelf-life 2 weeks
PREPARE	Roast on charcoal or gas grill

ISAAN SAUSAGE / Herb Sausage (Thailand, recipe 2)*(Fresh sausage type, coarse mixture) (see also page 216)***INGREDIENTS****Raw Materials:** (calculated for 10 kg batch)

80.00 %	Pork meat trimmings, lean	8.000 kg
20.00 %	Pork belly and back fat	2.000 kg

Extenders: ---**Additives:**

(per kg raw materials)		(total for 10 kg)
10.00 g	Common salt	100.00 g
2.00 g	Erythorbate	20.00 g

Seasonings:

(per kg raw materials)		(total for 10 kg)
1.00 g	Chilli paste	10.00 g
1.50 g	Soy sauce	15.00 g
1.00 g	Shrimp paste	10.00 g
1.00 g	Lemon grass	10.00 g
10.00 g	Fresh garlic	100.00 g
1.00 g	MSG (mono sodium glutamate)	10.00 g

PROCESSING

CUT	Pork meat and belly fat trimmings in small pieces
MIX	Pork meat, fats, additives and seasoning
GRIND	Mixture 5 mm
STUFF	Into natural pork casings (26-28mm)
STORE	Under refrigeration, self-life <2 days
PREPARE	Roast on charcoal or gas grill

RICE SAUSAGE (Asian cereal sausage)	see page 78
KEBAB	see page 106
LOW-COST FRESH SAUSAGES	see page 113
TRADITIONAL BLOOD SAUSAGES	see page 163
CHICKEN PRODUCTS	
a) Coated/breaded products	see page 189
b) Chicken burger	see page 191
MOO-YOH (Asian flour sausage)	see page 197
SPLEEN-LIVER SAUSAGE (Asian offal sausage)	see page 216
FLOSSY SHREDDED PORK	see page 217
SALAME (South-American, raw-fermented)	see page 219
MORCILLA (South-American blood sausage)	see page 219
SIMPLE DRIED MEAT (without additives)	see page 233
CHARQUE (South-American dried meat)	see page 236
BILTONG (South-African dried meat)	see page 237
PASTIRMA (Middle-East dried meat)	see page 238
JERKY (North-American dried meat)	see page 239
KILISHI (African dried and processed meat)	see page 241

ANNEX II

GLOSSARY

Acceptance test

The acceptance test is a type of sensory examination. Acceptance testing is used during product development to test the market potential of a new product ready to be launched.

Acid

An acid is a substance which decreases pH into the acid range ($< \text{pH } 7.0$) when dissolved in water. Acids can be inorganic (e.g. hydrochloric acid, HCl) or organic (e.g. citric acid) compounds.

Acidification

This term relates to the capability of microorganisms of forming acid when carbohydrates are degraded. Such acid can be of the desirable type for meat products, such as lactic acid but also undesirable such as acetic acid.

Actin

Actin belongs to the so-called contractile proteins (and myosin) of the myofibrils of the meat musculature. The protein actin accounts for approximately 20 percent of the muscular protein.

Actomyosin

Actomyosin is created by an association of actin with myosin, resulting under the influence of ATP in muscle contraction. Their dissociation results in muscular relaxation (in live animals).

Additives

The term additives as refers to food products (and meat products) manufacturing is defined as comprising all such materials or substances not classified as actual foods ("food by itself").

Agar-agar

Agar-agar is a swelling substance of plant origin. Extracted from red algae (Rhodophyta) and other algae, it is used as a gelatinizing/thickening agent in food manufacturing.

Air humidity, relative

The relative humidity of air (r.h.) is the ratio of water vapour contained in air of a certain temperature to the maximum water vapour content expressed in percent.

Air-dried

The term air-dried refers to non-smoked raw/uncooked meat products and sausages which, as the word implies, have been simply dried on air.

Airtight

When a container is described as closed airtight, the meaning is that materials used are impermeable to oxygen and therefore suitable for extending the shelf-life of enclosed products.

Alginate

Alginates are the salts of alginic acid (sodium alginate). They are obtained from marine algae through extraction and form highly viscous solutions in water. Contrary to products such as agar-agar or carrageenan, alginates do not gelatinate and are used as thickener in mayonnaises and gravies.

Antibacterial

Processes or substances defined as antibacterial are capable of inhibiting the growth or multiplication of bacteria or effecting outright kill of bacteria.

Antioxidants

Antioxidants are substances capable of slowing down oxidation, thereby postponing the occurrence of taste or colour alteration (e.g. rancidity).

Artificial casings

The use of artificial sausage casings made of cellulose, collagen, textile fibres or plastics is firmly established in meat processing. The advantages of artificial casings are their attractive designs, easy stocking and uniform calibre.

Ascorbic acid

Ascorbic acid (Vitamin C) or its salt (sodium ascorbate) is used in meat processing as cure accelerator to enforce the curing colour development. The reaction of ascorbic acid is fast and further accelerated by increasing temperatures. This makes it an ideal component in quick-cured and heat treated products. Sodium ascorbate reacts slower and is therefore mainly used in raw-fermented products.

ATP

ATP (adenosine triphosphate) is a chemical compound occurring in almost all cells of the living body. ATP plays a role in the processes of muscular contraction and relaxation. ATP is also useful in the manufacturing of raw-cooked meat product.

Autoclave

Autoclaves, also called retorts, are large pressure cookers achieving temperatures above +100°C and used for sterilization of meat products filled into hermetically sealed containers (cans, glass jars, flexible pouches, etc). Autoclaves can be designed as still or rotating autoclaves.

 a_w -value

The a_w -value is an important measure used in meat processing. The a_w -value describes the water activity, meaning the free water in the product. High a_w -values present good conditions for microorganisms, lower a_w -values inhibit activities of such microorganisms. Bacteria require a_w -values around and above 0.9, yeasts and moulds only need a_w -values above 0.6.

Bacteria

Bacteria are monocellular microorganisms of various shape and size. Bacteria are present everywhere, in soil, water, air, the intestinal tract, on all kinds of surfaces, etc. Some bacteria can cause food spoilage or food poisoning, other strains of bacteria are used in food products manufacturing (starter cultures used in raw-fermented sausage making, production of yogurt and cheese).

Benzpyrene (3,4-Benzpyrene)

Benzpyrene is a condensating aromatic hydrocarbon and a carcinogenic substance. 3,4 benzpyrene is generated during the burning or smoldering of wood when the smoldering temperatures are relatively high. However, smoked meat products remain far below the content of 1 ppm benzpyrene, which is considered the risk level.

Binder

The term binder is used for substances of animal or plant origin, which have a significant high level of protein that serves for both *water and fat binding*. Such substances include *high-protein soy, wheat and milk products*, such as isolated soy protein, wheat gluten or milk caseinate.

Biological value

This is the method of measuring protein quality. Protein is used in the cells of the human and animal organisms. The more protein is retained in the organism the higher is the level of utilization of the particular protein provided through food/feed and the higher is its biological value. The biological value is the ratio of protein consumed to the amount of protein retained in the organism and not excreted as urine or faecal matter. Isolated whey and egg protein are amongst the products with the highest biological value and serve as measurement (biological value of isolated whey = 100). Biological value of other foods: whole eggs 94, cow milk

91, fish 83, casein 80, beef 80, chicken 79, soy 74, wheat gluten 54, kidney beans 49.

Blood plasma

Blood plasma is the yellowish liquid obtained by centrifuging blood and contains 7-8% protein. This liquid is either stored frozen or spray-dried and stored as powder. It is used in finely-chopped raw-cooked (frankfurter type) sausages to increase the protein content and improve water binding.

Blood sausage

Blood sausages belong to the group of precooked-cooked products. In these products fresh blood (10-20%) is mixed with precooked animal tissues, cereals, vegetables, salt and spices. The final mixture is stuffed and heat treated again.

Boiling point

This term refers to the temperature at which a liquid changes over into gaseous state.

Boning

This term refers to the removing of bones from carcass parts of slaughter animals. It is often also called deboning.

Botulism

The term botulism describes a bacterial food poisoning caused by the botulinus toxin, which is discharged into the food by *Clostridium botulinum*. Botulism can occur in preserved meat, vegetable and fish products.

Bowl cutter

The bowl cutter is the most frequently used meat chopping equipment designed to produce very small lean meat and fat particles. Bowl cutters consist of a horizontally revolving bowl and a set of curved sharp knives rotating vertically on a horizontal axle at a high speed. Another name is bowl chopper.

Brine

The term brine describes a water/salt solution used for curing meat products.

Burger

Originally, burgers were made from *beef* (preferably lean cow meat), but in recent years also *chicken* and *mutton* burgers were introduced. Other animal tissues such as fats or connective tissue/tendons can also be part of the mixture, with quantities depending on the type and quality of the

products. Burgers are formed usually to disc-like shape with diameters of 80-150 mm and 5-20 mm height. Burgers are stored frozen and individually pan-fried before consumption.

Calibre

In meat processing, the term calibre refers to the diameter of casings and sausages.

Canning

This term refers to the filling of food into cans followed by hermetically sealing of the containers and heat treatment.

Carbohydrates

These are organic substances formed by the elements carbon, hydrogen and oxygen. Sugars such as saccharose and dextrose are the best known carbohydrates, but also dextrans, starches, cellulose and pectines belong to this group.

Carcass

The term carcass refers to the body of a slaughter animal (without internal organs) consisting of meat, fats, bones and connective tissues.

Carrageenan

Carrageenan is a polysaccharide produced by red algae and obtained by water extraction. It has good gelling properties.

Casings

Casings are defined as soft cylindrical containers used to be filled with sausage mix. Casings can be of natural origin or industrially manufactured (artificial). Natural casings are obtained by special treatment of animal intestines derived from slaughtering. Manufactured artificial casings are made of cellulose, collagen or synthetic materials.

Cellulose

Cellulose is the substantial framework of plant cell walls. Because it is not attacked by digestive juices, it serves as dietary fiber in human nutrition. Cellulose also serves as material for paper, packaging films and foils and artificial casings. It belongs to the group of polysaccharides.

Cereal sausages

For this product group sizeable quantities of various non-meat ingredients such as breadcrumbs, rice, potatoes, cassava, etc are incorporated into the basic mixture of pre-cooked lower value animal parts. Also liver or blood may be added thus making those cereal sausages either part of the liver or blood sausage variety. The term cereal refers to grain crops and other field crops.

Coarse

Coarse describes a degree of comminution, in this context not very finely comminuted.

Cold smoking

Cold smoking is the application of smoke to meat products at temperatures below 24°C. It is mainly used for raw-fermented sausages and raw hams.

Collagen

Collagen is an important component of connective tissue found in tendons, skin, bones and cartilage. Due to its high water holding capacity it is used as binding agent in blood sausages and gelatines. It serves also for the manufacture of artificial casings.

Colloid mill

Also known as emulsifier, this equipment is used for very fine cutting or comminution of sausage batters.

Common salt

Common salt (sodium chloride) is the sodium salt of hydrochloric acid (HCl) and is one of the most important aiding substances (additives) in meat processing. Common salt facilitates the extraction of protein (actin, myosin) and contributes to the taste.

Conduction

This term refers to the means of transmission of heat in food products consisting mainly of solids.

Connective tissue

Connective tissue consists of connective tissue proteins i.e. collagen, elastin and is found in many body parts, with particularly high quantities in tendons, skins and cartilages.

Convection

This term refers to the means of transmission of heat in food products which consist to a great extent of liquids.

Corned beef

The classical Corned beef was a by-product of meat extract production. Before refrigeration was available, the only way to utilize surplus beef from Latin-America and other regions of the Southern hemisphere for shipment to Europe was to produce meat extract. Originally a by-product, the cooked beef, which still has a high protein content, is filled into cans and heat sterilized. The result is Corned beef.

Core temperature

In meat processing, this term refers to the temperature achieved in the critical thermal point of products where it takes longest for the temperature to change.

Curing

Curing is the method used to achieve the desired red colour in processed meat products. The products are salted with a mixture of common salt (sodium chloride NaCl) and the curing agent sodium nitrite (NaNO_2). Sodium nitrite facilitates formation of a red curing colour and typical aroma/flavour.

Deep-freezing

This term refers to storage temperatures of -18°C and below and is ideally suited for long-term storage of meat and meat products.

Detergents

Detergents are substances used in cleaning and capable of relaxing the surface tension of water to enhance the cleaning effect. Most common are anion detergents (soaps), cation detergents (invert soaps) and non-ionogenic detergents.

DFD meat

The term DFD refers to "dark, firm, dry". Meat showing DFD properties can be identified by a pH-value above 6.2.

Erythorbate

Cure accelerator with similar effect as sodium ascorbate.

F-value

The F-value is a unit of measure for the heating effect obtained in heat-treated products. The letter "F" in F-value is derived from Fahrenheit (temperature scale used in the US). Preservation by cooking/sterilization of processed products following the F-value concept is far more reliable than orientation by core temperatures alone. Computation of the F-value and cooking according to F-value is based on inhibition or elimination of microorganisms and maintaining as far as possible the sensory quality of products.

Fat

Fat is defined as a substance under the category of triglycerides. It exists in various forms and is used in sausage production.

Fermentation

Fermentation is the breakdown of organic substances by fermentative microorganisms. During fermentation, carbohydrates are partly reduced

to acids or other substances (extraction of alcohol from sugar). In meat processing, fermentation occurs in raw sausage and raw ham production.

Flavour

This term is used in sensory evaluation and refers to a combination of taste and odour.

Freezing point

The term refers to the temperature at which a substance changes from liquid to solid. This temperature varies from substance to substance. Water freezes at 0°C, if salt is added the water/salt solution freezes at a much lower temperature. The freezing point of lean meat is at -1.5°C.

Fresh processed meat products

The characteristic of this group is that all meat and non-meat ingredients are added fresh (raw), either refrigerated or non-refrigerated, but not cooked. Most of the fresh meat mixes are filled in casings, which defines such products as sausages. If other portioning is customary, the products are known as patties, kebab, or burgers. Only prior to consumption the products are heat treated (frying, cooking) and usually consumed hot.

Friction smoke

A specific technique employed in smoke generation. Smoke is produced by pressing a wood log onto a rotating wheel. This causes friction and frictional heat so that the log smoulders and smoke is generated.

GdL

GdL stands for Glucono-delta-lactone and is obtained from dextrose. In watery solution, GdL changes rapidly into gluconic acid. The prime area of GdL application is the manufacturing of fast cured raw-fermented sausages.

Gelatine

Gelatine is made of collagen containing materials such as bones, cartilage and skins (rinds, hides). Gelatine is a high-molecular protein which swells in cold water and which forms viscous solutions in warm water. Upon cooling, a solid gel is obtained.

Grind

Grinding or mincing are terms used in meat processing, when bigger meat pieces are broken down in size by use of specialized equipment.

Grinder

The grinder is a machine used to force meat or meat trimmings by means of a feeding worm (auger, feeding screw) under pressure inside a

horizontally mounted cylinder (barrel, feeding worm housing). At the end of the barrel the meat is broken down in size by a cutting system consisting of star shaped knives (cutters) rotating with the feeding worm and perforated cutting discs (grinding plates).

Guar gum

Guar gum is a hydrocolloid obtained from the seeds of a leguminose plant and used as thickener in soups, gravies and sauces.

Halal

Refers in the narrower sense to Muslim dietary laws. An important feature as far as meat and poultry are concerned, is the slaughtering according to Halal rules which in practice mostly excludes prestunning of slaughter animals. Pork and pork based products are prohibited and pork-based food operations such as pig slaughtering or pork processing must be absent where processing of Halal meat and meat products takes place.

Hemoglobin

Hemoglobin is the red pigment of blood.

High hydrostatic pressure treatment

Method of food preservation where microbial reduction is achieved through application of high pressure (in the range of 3000 bar) on the food product.

Hot smoke

Hot smoking is the form of smoking which involves high temperatures (>50-70°C) and is mainly used for frankfurter-type sausages.

Hot-boning

This term describes the process of separating meat and bones from freshly slaughtered unchilled animal carcasses.

Hurdle concept

The hurdle concept serves as a system of estimating and influencing the shelf life of meat and processed meat products. In this concept several individual measures (hurdles) are combined to prevent microorganisms from growing/multiplying such as temperature, humidity, water content, pH-value, salt concentration, presence of preserving substances, etc.

Hydroxyproline

An amino acid, which in meat exclusively occurs in the connective tissue and which is therefore used as a parameter in connective tissue protein determination.

Hygrometer

Such a device is used to determine the relative air humidity. Hygrometers are available as simple hair hygrometer models and electronic aspiration psychrometers.

Intermediate moisture food

The term Intermediate Moisture Food characterizes processed products, which have a low a_w -value and possess great storage stability.

Irradiation

In the food sector irradiation by ionizing high energy gamma rays, x-rays, or in some cases by high energy of electron sources, is used in some countries (where such treatments are legal) for reducing or eliminating microbial contamination in food, control parasite such as trichinae in meat or insect in grains and sanitize packing material prior to food packaging or treat drinking water.

Kidney fat

Also known as kidney tallow, this term describes the layer of fat where the kidneys are embedded.

Lactic acid

Lactic acid belongs to the so called food grade acids as do citric acid and acetic acid, and are used to lower the pH-values.

Lactobacilli

Lactobacilli are gram positive microorganisms which have the ability to form acids from carbohydrates. They are used as starter cultures in raw-fermented sausage production.

Liquid smoke

Liquid smoke is obtained by condensation of natural smoke in liquids and used in meat processing by being sprayed into smoking chambers where it will condensate on the surfaces of the products or by directly adding to meat mixes.

Liver sausage

Liver sausage belongs to the group of precooked-cooked sausages and is composed of precooked meat trimmings and fatty tissues and liver (10-20%). The liver (mainly added raw) provides not only the name for this sausage type but also contributes to its unique flavour and taste. In general two types of liver sausages are produced, the coarse-mixed type and the fine-emulsified type.

Meat inspection

Each slaughtered animal should undergo official meat inspection after slaughtering to ensure that only meat fit for human consumption enters into the sales and distribution chain. Respective national regulations must be observed.

Meat products

Meat products are such food products which are exclusively or predominantly composed of meat.

Microorganism

The term microorganisms is used collectively for all live organisms which in their cellular form cannot be detected upon visual inspection. The term microorganisms refers to bacteria, yeasts and moulds. All these microorganisms are of great importance in meat processing.

Moulds

Moulds are microorganisms which may be desirable or undesirable in meat processing. They can cause a multitude of damages on surfaces of meat products, split proteins and break casings by digesting celluloses. Taste and colour deviations can also occur. But some moulds are also helpful by forming a protective and flavour providing layer on the surface of air-dried raw sausages.

Mono sodium glutamate (MSG)

MSG is used in larger quantities as a flavour and taste enhancer in meat products and cooked foods especially in Asia. The use of MSG is often questioned as it can cause allergies and health problems.

Myofibrils

Myofibrils belong to the structural elements of a muscle and form the content matter of the muscular fiber or muscle cell, enclosed by the sarcolemma. They develop from the filaments of the myofibrillary proteins actin and myosin.

Myoglobin

Myoglobin is a proteinaceous substance in muscular meat responsible for oxygen transport in the live muscle and for the colour of fresh lean meat, but also for the curing-red colour in processed meat products after its reaction with nitrite. In this case, the myoglobin connects with the degradation product NO of the nitrite resulting in nitrosomyoglobin.

Myosin

Myosin filaments represent approx. 40% of muscular proteins. As a result of association with actin they form the so called actomyosin,

responsible for muscular contraction. A dissociation of these two muscle proteins brings about muscular relaxation.

Nitrite

Nitrite (sodium nitrite) is used for curing of meat and meat products such as raw-cooked sausages, cooked hams, raw hams, raw-fermented sausages and other products. Nitrite (NaNO_2), or rather nitrogen oxide (NO), which is formed from nitrite in an acid environment, combines with myoglobin to form nitrosomyoglobin and results in the red curing colour of the meat. Nitrosomyoglobin is heat stable i.e. when the meat is heat treated the bright red colour remains. In larger quantities, which, however, are not needed in meat curing, sodium nitrite has toxic effects.

Nutritive value

The nutritive value of a meat product is determined by its content levels of proteins, carbohydrates, fats and other nutrient such as mineral salts and vitamins (see also Biological value).

Organic non-fat

In simple analyses of meat products, only the fat, water and mineral contents are determined by extraction and drying respectively. The remaining constituents are described as organic non-fat (ONF), which can contain proteins and remains of carbohydrates. Minerals as inorganic compounds occur in very small quantities and can be determined by burning the sample in a furnace.

Organoleptic test

Organoleptic tests are sensory tests based on perceptions registered by the human senses, such as smell, taste, sight or touch. The testing involves colour development and retention, firmness, consistency, odour, flavour, taste and appearance.

Pasteurisation

Pasteurisation refers to the heat treatment at temperatures of up to 100°C , mostly in the temperature range of 60 to 85°C . Pasteurized products still contain a certain amount of viable ("living") microorganisms. Their growth in the stored product can only be prevented under low temperatures. Products must therefore be kept under refrigeration (0° - 5°C).

Perforated disc (grinder plate)

Perforated discs with holes of varying diameter are used with grinders as a mechanical gate through which meat being cut or comminuted can pass. By selecting the diameter of the holes in these perforated discs, the final particle size is determined.

pH-value

The pH-values range from 1.0 to 14.0 with its neutral point at pH 7.0. The acidic range is below 7.0, the alkaline range above 7.0. In meat processing, the pH-values range from 4.0 to 7.0.

Phosphates

Phosphates have a wide application in meat processing. They directly increase the water-holding capacity of muscle meat by raising the pH-value as their own pH is above 7.0 and also stabilize the texture of meat products by increasing protein solubility in connection with salt. The most common phosphates in meat processing are Sodium tri-polyphosphate STPP (pH 9.8) and Sodium di-phosphate SDP (pH 7.3). The usual dose is 0.05 %.

Precooked-cooked meat products

These products can be manufactured from a variety of animal tissues. The animal tissues used are precooked before processing. Only liver (for liver sausage) and blood (for blood sausage) are added uncooked (raw) to the mixture. Precooked-cooked sausages can only be cut or sliced when cold. According to the ingredients used, five types of precooked-cooked sausage products can be distinguished: liver sausage, blood sausage, cooked gelatinous meat mixes, cereal sausage and corned beef.

Presalting

The method of pre-salting meat as an initial step in meat processing was common in former times to increase storage properties and facilitate extraction of protein from fresh and ground raw meat materials. Presalting is not widely used in modern meat processing, as it delays production and may cause hygienic risks.

Preservation

The term preservation refers to all measures taken to extend the shelf life of meat and meat products. Those measures can be both physical as well as chemical methods. The most common are heating, cooling, freezing, drying, smoking, lowering of pH-value and the addition of salt and nitrite.

Protein

Proteins consist of large molecules of amino acids. Many of them are soluble, have the ability to swell in water and denature upon heating. Particular use is made of such protein properties in meat products manufacturing. Proteins are the most important constituents of meat and meat products.

PSE meat

The term PSE refers to “pale, soft, exudative” and characterizes meat which shows poor water-binding capacity due to a non-normal fast drop of the pH after slaughter.

Rancidity

Rancidity is the result of enzymatic or autoxidative fat spoilage. Rancidity is easily detected by sensory testing.

Raw-cooked meat products

For these products, the components meat, fat and non-meat ingredients are processed raw (“raw”=uncooked) by comminuting and mixing. The viscous mix/batter is portioned (in sausages, etc.) and then submitted to heat treatment (“cooking”), where protein coagulation results in the firm-elastic texture typical for ready-to-eat raw-cooked products. Raw-cooked meat products are mostly manufactured and marketed as sausages in small to larger calibre casings, but are also available as meat loaves, meat balls or as canned products. The most common are the small-calibre “Frankfurters”, “Vienna sausage” and “Hotdogs”, the large calibre “Bologna” and “Lyoner” and the canned “Luncheon meat”.

Raw-fermented sausages

These are uncooked meat products and consist of comminuted lean meats and fatty tissues with a mixture of salts, nitrite (curing agent), sugars and spices. Sometimes fermenting organisms (microbial starter cultures) are added. After stuffing the mixture into casings, the sausages undergo a drying and ripening process. Here bacterial fermentation (lowering of pH to 4.9 – 5.4) and dehydration (moisture content about 30%) takes place. The products are traditionally not subjected to heat treatment and usually also consumed raw.

Reconstituted

In meat processing, this term refers mainly to products such as cooked hams, where individual pieces of meat are put together to form a bigger ham.

Reduction

This term refers to the chemical process in which the substance oxygen is chemically reduced. One typical example is the reduction of sodium nitrite (NaNO_2) to nitrogen oxide (NO) during curing.

Refrigeration chain

Meat and processed meat products are highly perishable goods and must therefore be generated, stored and transported under refrigeration. All these individual stages of refrigeration form the “refrigeration chain” or “cold chain”.

Rind

By definition, the term rind refers to the scalded and dehaired skin of pigs, which contains mainly connective tissue proteins.

Sausages

This term refers to meat mixes which are stuffed into natural or artificial casings of various calibres.

Saccharose

The scientific term saccharose refers to the common household sugar, which is partly also used in the manufacturing of sausage products (taste, assisting starter cultures). Saccharose is sweeter than dextrose.

Salmonellae

Salmonellae are the best known and most feared type of bacteria, as they can lead to a great number of food poisonings (vomiting, diarrhoea, typhoid fever). Salmonellae belong to the Enterobacteriaceae family. Heating to a temperature of 68°C will kill salmonella bacteria reliably; storage temperatures of below 4°C inhibit their growth. Salmonellae have been primarily being identified in pork and poultry meat.

Separator

A separator is a device designed to separate different components from liquid or solid substances. One well-known type of separator equipment is the blood separator used to separate and obtain blood plasma; other types include the hard separator used for separating muscular protein and connective tissue from bones and the soft separator used to separate muscle tissue from connective tissue.

Sheep casing

When the small intestines of sheep are cleaned and properly processed, natural casings are obtained with small calibres (18-24mm). These casings are edible and mainly used for frankfurter type or BBQ sausages. Available and widely used are also artificial casings, which resemble sheep casings. These casings are obtained from collagen material and are also edible.

Smoke

The most common way of generating smoke is by smoldering of wood, wood shavings or sawdust. The process of smoking plays an important role in meat processing, as it not only contributes to meat product preservation, but also adds to the flavour and taste of such products.

Soy protein

In terms of nutritional value, soy protein is a high-quality protein with a wide application in meat processing all over the world. Depending on the

way of fabrication, it acts as binder (soy isolate) or meat extender (soy concentrate).

Spices (condiments, seasonings)

Spices are derived from certain parts of plant species processed to maintain their naturally occurring taste or flavour for use in foods and processed products.

Stabilizer

When stated in the list of ingredients, stabilizer is regarded as a class name which stands collectively for all ingredients and additives used for product stabilization in the broadest sense. As regards the manufacturing of meat products, citrates and phosphates are viewed as stabilizers.

Delta-D (Staged) cooking

This term refers to a cooking technique used in cooked ham or other cooked products of larger calibres such as Mortadella sausages. According to this technology the "cooking" temperature (cooking chamber or cooking vat temperature) is kept in relation to the core temperature of the product, in practice always approx. 25°-30°C above the prevailing core temperature. Upon reaching the chosen temperature of the cooking chamber/cooking vat (e.g. 75°C for cooked ham), this temperature is not increased further, but cooking continues until the required core temperature in the product has been achieved. This method reduces cooking losses and sensory damage.

Starch

Starch is a polysaccharide based on glucose. When placed in warm water (+50°C), starch undergoes intensive swelling resulting in glue formation. Because of its glue-forming property, starch is used in its modified form as a binding agent for soups and sauces, but also as a filler with binding properties in meat products.

Starter cultures

This is the term used for cultures of microorganisms which are helpful in fermentation of foodstuffs. Commercially marketed starter cultures for raw fermented sausage production usually contain *Lactobacilli* (lowering of pH-value) and *Micrococci* or *Staphylococci* (flavour building). Such cultures are marketed in either freeze-dried (lyophilized) or deep-frozen form. Due to specific metabolic reactions, starter cultures initiate fermentation processes such as carbohydrate degradation and acid formation, nitrate reduction and thereby stable red colour formation and flavour development.

Sterilization

Sterilization refers to the heat treatment of meat products at temperatures above the boiling point. For meat and processed meat products mostly the temperature range of +105 to +121°C is used. Sterilized products are free of vegetative forms of microorganisms and practically also free of spores (Exception: Commercially sterile products, see page 294). Depending on the degree of sterilization, packaging material used and prevailing storage temperature, the shelf life of such products can be substantially extended.

Temperature

This term describes a measure for hotness or coldness of solids, liquids or gases, and is expressed in degrees (e.g. Celsius, Fahrenheit).

Tenderizer, biochemical

In this context, the term tenderizer refers to enzymes which can split meat proteins, thus increasing the tenderness. Such tenderizers, used in meat technology, are papain, bromelain, actinidin and ficin extracted from papaya, pineapple, kiwi and pig respectively.

Tenderizer, mechanical

In this context, the term tenderizer refers to equipment or tools used to incise (steak) meat pieces intended for grilling or pan-frying or production of cooked hams prior to curing/tumbling. The purpose of this action is to break down muscle fibre structures (tenderness) and also enlarge the meat surface for protein extraction.

Tendon

Tendons are connective tissue structures made of elastin, which serve to attach muscles to bones. Another name for tendon is sinew.

Texture

This term is used in sensory evaluation describing those physical properties of foods, which are noticed by touch, bite and feel.

Tumbler

Tumblers are used for the processing of meat products such as whole-muscle or reconstituted hams. A rotating drum with steel paddles inside slowly moves the meat pieces causing a mechanical massaging effect. This process helps to achieve equal brine distributions and sets free muscular protein from the meat tissue which joins the meat pieces firmly together during the following heat treatment.

TVP

The abbreviation TVP stands for textured vegetable protein. Suitable plant proteins, in the first place soy protein, are treated to obtain a

certain structure and texture and are used as extenders or meat replacers.

Vacuum stuffer

A vacuum stuffer (filling machine) has a built-in vacuum pump which extracts air from the sausage mix prior to stuffing. This results in reduction of air pockets in the mix, the presence of which could lead to discolouration or gel/fat separation in the final product.

Water

Water (H₂O) is the main component of meat (up to 80% in lean meat). Besides this "natural" water, water can also be used in some processed meat products as an ingredient. During the manufacture of raw/cooked meat batters water acts together with salt and phosphates to solubilize muscle proteins. Water is also needed as a solvent for curing substances or other non-meat ingredients.

Water activity

See a_w -value

Water holding capacity

The ability to bind or release water is an important property of muscular protein in meat processing. For raw-cooked products a high water binding capacity is desirable, but for raw-fermented products a low water binding (increased release of water) is important. A first step is therefore the selection of suitable meat material and identification of suitable additives to support the desired properties. The higher the pH-value, the better will be the water holding capacity; the lower the pH-value, the higher the water loss.

Wet curing

Wet curing describes a technique where meat pieces are first injected with and later submerged in brine.

Yeasts

In meat processing yeasts can be both, desirable and damaging. Selected yeasts are applied in fermentation of bread, raw hams, raw sausages and cheese, but undesirable yeasts can result in spoilage of meat products due to gas formation and excessive growth.

Yield

In the context of meat production and processing, yield describes the fresh weight: product weight ratio.

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