

Good Hygienic Practices in Meat Processing

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SUMMARY

Meat processing hygiene is part of Quality Management (QM) of meat plants and refers to the hygienic measures to be taken during the various processing steps in the manufacture of meat products. Regulatory authorities usually provide the compulsory national framework for food/meat hygiene programmes through laws and regulations and monitor the implementation of such laws. At the meat industry level, it is the primary responsibility of individual enterprises to develop and apply efficient meat hygiene programmes specifically adapted to their relevant range of production.

INTRODUCTION

Operations in meat processing plants comprise the manufacture of value-added meat products from primary products of meat origin and non-meat origin. There are three principles of meat hygiene, which are crucial for meat processing operations. Prevent microbial contamination of raw materials, intermediate (semi-manufactured) goods and final products during meat product manufacture through absolute cleanliness of tools, working tables, machines as well as hands and outfits of personnel. Minimize microbial growth in raw materials, semi-manufactured goods and final products by storing them at a low temperature. Reduce or eliminate microbial contamination by applying heat treatment at the final processing stage for extension of shelf life of products (except dried and fermented final products, which are shelf-stable through low a_w and pH). The above three principles guide meat hygiene programmes in the further processing of meat. However, meat processing hygiene is more complex. In particular, the hygienic treatment of meat before reaching the processing stage is of utmost importance for the processing quality of the meat. Failures in slaughter hygiene, meat cutting and meat handling/transportation and in the hygiene of by-products and additives will all contribute to quality losses and deterioration of the final processed meat products. Highly contaminated raw meat is unsuitable for further processing. Final products made from hygienically deficient raw meat materials are unattractive in colour, tasteless or untypical in taste with reduced shelf life due to heavy microbial loads. Moreover, there is also the risk of presence of food poisoning microorganisms, which can pose a considerable public health hazard. In the light of growing consumer consciousness as well as regionalization and globalization in trade, quality conscious meat plants need *internal quality control/quality management schemes* not only for the final products but also for the raw materials and the various processing steps. Such Quality Management Schemes (QM) have technical and hygienic components. *Technical* aspects encompass *product composition, processing technologies, packaging, storage and distribution*. For the *sanitary quality and safety* related to meat processing, THE useful schemes include Good Hygienic Practices (GHP). Microbial meat spoilage or food poisoning through meat can be prevented if the microbial load/bacterial contamination, which occurs during slaughtering and meat handling, is kept as low as possible. The key for achieving this is strict meat hygiene including an uninterrupted cold chain throughout the entire meat production and handling chain.

Table 1. Recommended Microbiological Criteria for Fresh Meat

Microbiological Criteria	Good Microbiological Standard	Critical Microbiological Condition	Not Acceptable
Total Plate Count per cm ²	Less than 10000 <104	Between 10000 and 100000 >104 - <105	More than 100000 >105
Enterobacteriaceae per cm ²	<100	>100 - <1000	>1000

Meat hygiene is a complex field, based on regulations by competent authorities and meat plant internal hygiene programmes, to be supervised by the plant management. Those programmes will only be successful if meat plant staff are familiar with and active in observing basic hygiene requirements. In order to facilitate the application of hygiene requirements, it has proven useful to differentiate between:

- Personal hygiene
- Slaughter and meat processing hygiene
- Hygiene of slaughter and meat processing premises
- Hygiene of slaughter and meat processing equipment

The topics are of equal significance. Negligence in any of the four areas may give rise to hazards, which can cause economic losses and affect consumers' health. Some key requirements for meat processing plants are listed below. More detailed hygiene requirements are laid down in national regulations and in international codes, such as FAO/WHO CODEX ALIMENTARIUS Code of Hygienic Practice for Meat (CAC/RCP 58-2005). Guidelines on slaughter hygiene or meat transport and storage hygiene are not included hereunder. However, as meat is the primary material for processed meat products, the application of hygienic practices in slaughterhouses and throughout the cold chain is equally important.

Principles of Personal Hygiene

- Wear clean protective clothes
- Washing hands before starting work
- Repeatedly washing hands during work
- No finger rings, watches, bracelets ³/₄ Access to production areas with working clothes only
- Cleaning/disinfection of hands/tools/clothes if there was contact with highly contaminated subjects or abnormal animal parts likely to contain pathogens.
- Fresh wounds through knife cuts etc. must be covered by a water tight bandage. Workers with purulent wounds are not allowed to work with meat. (Risk of spread of *Staph. aureus* bacteria).
- Strict toilet hygiene must be observed (removal of apron, hand washing and hand disinfection). Toilets must be kept clean and must not have direct access to production areas. (Risk of spread of *Salmonella*).
- Periodic medical examination of staff

Table 2: Microorganisms Causing Microbiological Spoilage of Meat

Putrefaction	Pseudomonas (“Cold room flora”), Proteus, Clostridium
Souring	Lactobacillus, Enterococcus, Pediococcus (“Lactic acid bacteria”)
Fermentation	Yeasts (Saccharomyces), Enterobacteriaceae, Lactic acid bacteria
Turbidity (cloudy brine in meat juice)	Lactic acid bacteria, Enterobacteriaceae (e.g. vacuum-packed meat, sausage slices)
Greenish discoloration	Lactic acid bacteria
Slime formation	Pseudomonas, Streptococcus, Enterobacteriaceae (on open meat), Lactic acid bacteria (on vacuum packed meat and meat products), Yeasts (on raw fermented products such as raw hams)
Rancidity of fats	Mainly due to presence of oxygen, but certain microorganisms are also capable of causing fat deterioration.
Mold growth	Penicillium, Aspergillus, Mucor

Basic Hygiene of Meat Processing

- Ideally meat cutting/deboning should be carried out in climatized rooms (approx. + 10°C) with low air humidity. Meat should be brought in progressively and not accumulate on work tables.
- If visual contamination of manufacturing meat occurred, do not try to wash it off but remove it with knives by cutting off superficial meat parts in the case of minor contamination. Discard the meat in case of heavy contamination.
- Do not hose down floor and wall areas or equipment next to meat processing operations or final products with a power hose. (Risk of contamination by aerosol/droplets).
- Never take meat pieces, which accidentally had contact with the floor or other contaminated surfaces, back onto working tables or into meat processing machines.
- Containers for meat, fat, or semi- or fully processed meat products must not be placed directly on the floor but on hygienic stands, pallets etc.

Hygiene of Meat Processing Premises

Meat processing facilities must meet the following basic hygienic standards in order to ensure and maintain clean and hygienic working conditions: ³/₄Adequate rooms for personnel must be available including sections for changing clothes and for personal hygiene.

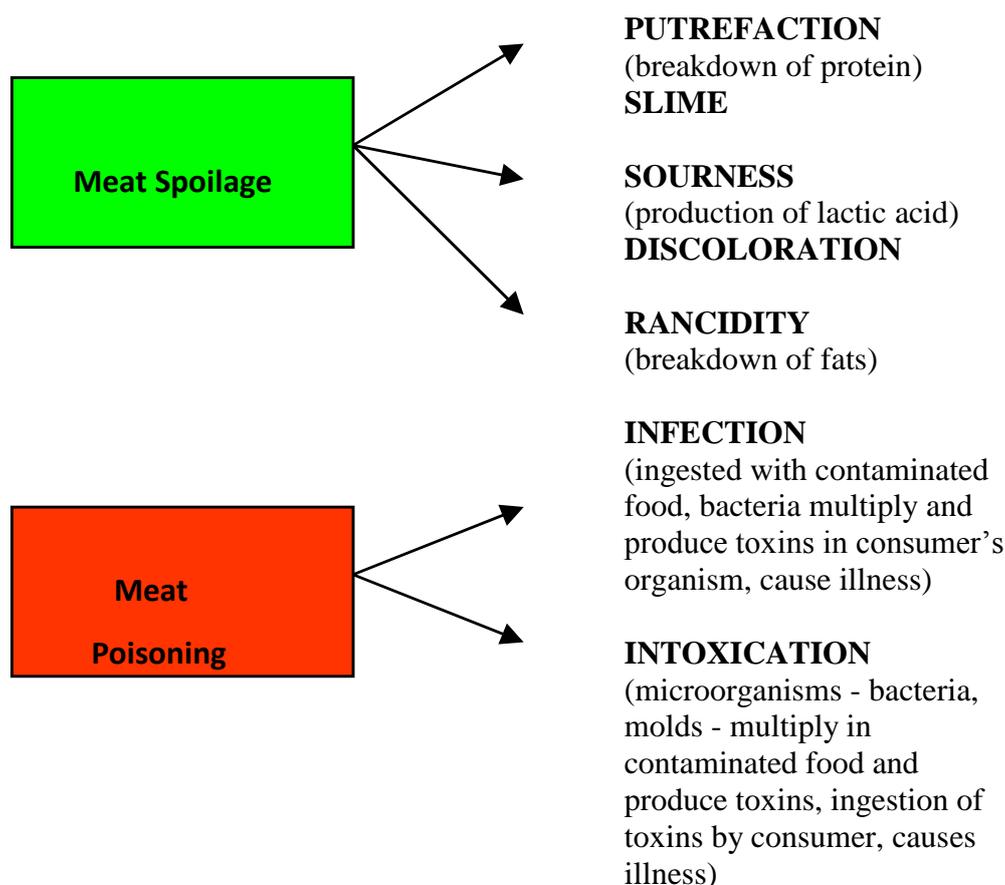
- Wall windows must be positioned at a sufficient height from the floors in order to allow profound washing and disinfection of floors and walls. Wall windows for processing plants must be at their lowest part at least 2 m high over floor level. Window frames should be of non-corrosive material e.g. aluminum or similar and must not be painted.
- Walls in all rooms, where meat and by-products are handled, must have smooth and easily washable surfaces up to a minimum height of 2 m in processing plants. Walls should preferably be covered with wall tiles or at least with washable paint.
- Floors in the mentioned sections must be impermeable for water and reasonably smooth for good cleaning, but anti-slip for workers safety. They are usually made of fat-resistant concrete. Additional covering by epoxy substances or floor ceramics are possible.
- In order to facilitate proper cleaning, the junction between floor and walls must be coved, i.e. rounded (not rectangular), which can be achieved by extending the floor concrete up to a height of 10-50 cm alongside the walls. If the concrete layer alongside the wall is sufficiently thick (approx. 10-20 cm), it serves also as shock absorber and protects the walls against damage by transport vehicles, such as trolleys, fork lifts etc. Appropriate coves at wall-floor junctions can also be achieved by using special curved wall tiles.
- All wet rooms must have floor drains, which should be covered by non-corrosive metal plates or grills. The covers should be easily removable for proper cleaning of the drains. Drain sinks must be of the siphon type (anti-smell).
- Provisions must be made to channel waste water from hand-wash facilities, cool room evaporators, tool sterilizers, etc. by means of water pipes or similar directly into effluent drains without contaminating the floor.
- Rooms for meat processing should have sufficient ventilation. Air conditioning is only required in meat cutting/deboning rooms (10 - 12°C).
- Supply systems for electrical wiring and pipes for hot and cold water as well as for compressed air should not hamper cleaning operations and be out of reach of possible dirt contamination (Fig. 478). Insulations for hot water pipes must have smooth surfaces and be washable.
- Openings for ventilation must be bird- and insect-proof.

Hygiene of Meat Processing Equipment

In production lines in the meat industries equipment and hand-tools should be used, which enable workers to perform all operations according to Good Hygienic Practices. It is the responsibility of the meat plant management to provide adequate equipment for all working places. For equipment manufacturers, directives have been issued as to proper design and construction of meat processing equipment. Designs must allow easy and

profound cleaning and avoid any accumulation of difficult to remove organic matters. As a principle in modern meat industries it is commonly accepted that tools and surfaces in contact with meat should be made of food grade stainless steel or synthetic materials. Stainless steel must be used for working tables, meat hooks (at least their parts contact in meat), blades of knives, saws, cleavers and axes. All parts of machinery in contact with meat, fat, sausage mixes and meat ingredients must be of stainless steel such as frozen meat cutter, grinder, meat mixer and tumbler, meat emulsifier, sausage stuffer, brine injector etc. The bowls of bowl cutters are nowadays also mostly made of stainless steel. All the stainless-steel parts must be smooth, easily accessible for cleaning and without hidden spaces, where particles of meat materials may accumulate.

Fig.1: Impact of Bacteria on Meat



Galvanized steel or food-grade aluminum are useful materials in the meat industries as they are non-corrosive. Those materials should however not be in direct contact with meat, as they are not sufficiently smooth or may release unwanted substances. But they are very suitable materials for overhead rails and supporting structures, working platforms and frames for tables and machinery. Food grade synthetic materials are used for many types of meat containers and for handles of knives and other hand tools, for cutting boards and some internal parts of meat processing equipment such as washers, parts of valves etc.

SUMMARY

In summary it can be stated that Good Hygienic Practices in meat processing requires efforts by both management and staff. It is the duty of the plant management to procure investments in good quality premises and equipment and in continuous plant and equipment maintenance. For the meat plant staff it is an obligation to observe during all meat processing operations relevant hygienic rules. Such efforts will result in good storage life of attractive meat products with desirable appearance, flavour and taste

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