# Thermal Processing for meat preservation

Heat treatment of processed meat products serves two main purposes:

 **Enhancement of desirable texture**, **flavour** and **colour,** in order to make meat products more palatable and appetizing for consumption.

 **Reduction of microbial content** thus achieving the necessary
- preservation effects for an extended shelf life (storability) of the products and
- food safety effects by eliminating potential food poisoning agents.

The heating parameters to be applied in meat processing can vary considerably in temperature and time depending on the type of product.

Heat treatment methods cause various physical, chemical alterations in meat, which result in the beneficial **sensory** and **hygienic** effects on the processed products.

When mankind learned to use fire for food preparation, the **aspects of palatability** were clearly important. Heat treatment became the common way of making meat palatable for consumption. The impact of high temperatures induces coagulation and denaturation of meat proteins and structural and chemical changes of fats and carbohydrates, which make meat tastier and also more tender. In addition, the absorption of nutrients from heat treated meats in the digestive tract of humans is improved.

**Types of heat treatment**

Principally, for heat treatment (also called "thermal treatment") of meat and meat products, it can be distinguished between products which undergo

**a.** Heat treatment at temperatures below 100°C, mostly in the temperature range of **60 to 85°C**, also called **"pasteurization"** or simply **"cooking"**.
**b.** Heat treatment at temperatures of **above 100°C**, also called **"sterilization"**.

All such products will achieve a more or less prolonged shelf life through reduction or complete destruction of microbial populations by the heating process (thermal reduction/thermal destruction).

Both groups of products have the following in common: They are

 **filled in containers** such as casings, cans, glass jars or synthetic pouches, which are closed or sealed after filling
 submitted to **thermal treatment** with a defined temperature and time combination that reduces or eliminates the microorganisms in the product, thus providing a prolonged shelf life.

The difference between the two groups (**a**) and **(b**) of heat treated meat products lays in their microbial status achieved, which determines how these products can be stored after thermal treatment:

 **Cooked** or **pasteurized** products (which are heated at temperatures below 100°C or maximum up to 100°C) still contain a certain amount of viable or "living" microorganisms. These are the more heat resistant spore forming types, which survive boiling temperatures (100°C). Their renewed growth in the finished and stored product can only be prevented by applying low temperatures. Such products (group **a** above) must therefore be **stored refrigerated** (0°-5°C).

The best known pasteurized animal product is pasteurized fresh milk, where pathogenic (zoonotic) microorganisms (such as agents of Tuberculosis, Brucellosis or Listeriosis), if present, are destroyed, but spoilage bacteria may have survived. Pasteurized milk has therefore to be kept under refrigeration. In the meat sector, cooked ham in sealed and afterwards mildly heat treated plastic pouches, or sausages heat treated in casings, are examples for **pasteurized** products. The internal temperatures, for sensory reasons, should not exceed 72-78°C. Refrigerated storage is therefore mandatory after processing.

 **Sterilized** products (group **b** above) (which were heated at temperatures of above 100°C combined with sufficient heat impact time to achieve the necessary sterilization effect), are produced free of viable microorganisms and can therefore be stored **under ambient temperature** ("shelf stable"). Practically all meat products in hermetically sealed containers (tin cans, glass jars, retortable pouches) are sterilized products and can be stored at ambient temperature.
In the rare event of only *pasteurizing* meat products in cans, glass jars or retortable pouches, a clear indication on their label must inform consumers that storage under refrigeration is mandatory. It is of utmost importance that meat processors, food handlers and consumers are aware of the difference between pasteurized and sterilized products. The presence or absence of spore forming microorganisms, which depends on the intensity of the heat treatment, decides on the classification "**pasteurized"** or "**sterilized"** products.

## Effect of heating on meat quality

Heating improves the palatability of meat by improving the color, flavor and taste.

**Effect on color:**

- Color of meat is affected by heat treatment. In fresh meat, color of meat varies form Purplish red (Myoglobin) to Bright red (oxy-myoglobin) to Brown (met-myoglobin).
- While on cooking, these compounds are converted into Globinmyohaemichromogen (Brown) and Globinmyohaemochromogen (Dull red).
- Color of cured meat is pink and it remains pink on cooking. Pink color of the meat is due to pigment Nitrosohaemochrome.
- Surface browning also occurs and depend on composition of meat (Maillard reaction) and Cooking method.

**Weight loss:**
In case of cooking, weight of meat is lost by:

- Evaporation of moisture
- Drip loss of lipids (it gives desirable flavor and palatability to meat)

Lipids on heating become liquid and their cell wall rupture. Lipids ooze out of cell and lost as drip.

**Change in composition:**
After evaporation of the moisture and drip loss of lipids, % composition of other components changed.

**Protein denaturation:**
Muscle protein starts denaturation at $50^{o}$C and most of the muscles or major portion of the protein is denatured at 60-$70^{o}$C. Denaturation of proteins causes tenderness of meat.