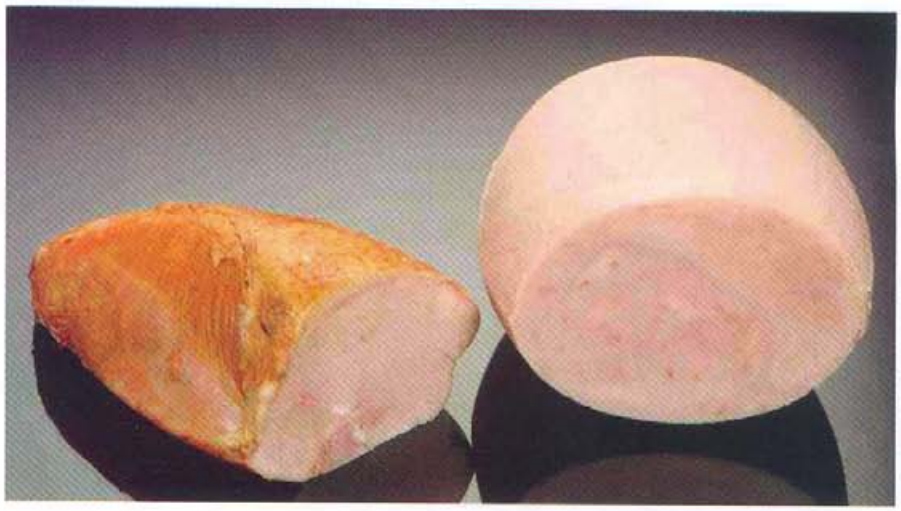
Cooking processes for whole-muscle products

The manufacture of whole-muscle cooked meat products is composed of a whole series of steps. Part 2 of a closer look at the characteristics and peculiarities of the last phases of the process, which are: cooking, cooling and final preparation.



By Josep Lagares, general manager, Metalquimia

It is very difficult to determine an optimum cooking method. Our experience has taught us that each product can have its optimum type of cooking and that similar products may give different results depending on the factory and/or the country. There are three basic types of cooking, which must ensure: good development of the products' sensory characteristics, obtaining an adequate internal temperature and a sufficient pasteurisation value.

Cooking at constant temperature

In this type of cooking, the temperature of the medium (air or water) or external temperature is maintained constant, at a maximum value, from beginning to end of the thermal processing.

The end of the cooking cycle will be determined by when the centre of the piece reaches a certain temperature, known as core temperature. This kind of cooking is the most extensively used, giving overall acceptable results *(see chart 1)*.

Cooking at decreasing temperature

This is the traditional method of cooking. It begins with a high initial external temperature (for example, between 80 - 90°C), which is maintained for a certain length of time until the thermal centre of the piece reaches a predetermined temperature (for example, between 50 - 55°C). Then the external temperature is regulated to a lower temperature (70 - 75°C) for the duration of the cooking process *(see chart 2)*.

In comparison with other cooking methods, this one usually results in products of lower yield and shorter shelf life as well as a lack of cohesion in the slices. It also has a negative impact on organoleptic properties of the product's surface, creating problems of overcooking in this area of the piece. This method should be ruled out from the outset unless some imperative need exists (lack of time, insufficient material, etc.).

Cooking at increasing temperature

We can distinguish between two types: Step by step Cooking and Delta T Cooking.

- Step by step cooking: In this cooking method, the external temperature is increased in a graded fashion, in various successive stages, until the desired temperature is reached in the thermal centre of the piece *(see chart 3)*. This type of cooking produces good results, above all in zero cooking loss products, although the cooking times are longer than in the methods explained above.
- Delta T cooking: What is known as Delta T cooking is the thermal processing in which the external temperature is increased continuously, in a line with the increase in temperature in the thermal centre of the meat piece.

At the end of the process the external temperature is maintained constant, as in the constant temperature heating method explained above *(see chart 4)*.

This type of heating produces very good results from the organoleptic point of view (the alterations due to overcooking of the surface are practically zero) as well as in regard to finished product yield. One negative point, however, is its long duration, and therefore, at an industrial level, it is not very viable and is rarely used. It has been shown that a Delta T heating at 25°C produces optimum results from the point of view of yield, as well as with respect to the organoleptic aspects of the finished product.

Final temperatures

Whatever cooking process is used, the temperature in the thermal centre of the piece is what will determine the end of the cooking process. These temperatures will vary depending on the type of product being processed, the desired yield and the organoleptic characteristics desired in the finished product.In general:

- Cook-in Products: Final core temperatures of 65-69°C.
- Products with Cooking Loss (open bag cooking): Final core temperatures between 67-71°C.
- High Quality Products: In these products it is precisely the cooking loss that is desired, therefore thee final core temperature in them usually reaches 70-71°C.

Cooling

This phase has a strong influence on the final characteristics and quality of the finished product. Cooling of the meat pieces after cooking, and the way in which this has been carried out, can affect the final yield as well as cohesion of the slices and the degree of pasteurisation.

Once the cooking process has been completed, it is recommendable to pre-cool the product by means of shower or immersion in water. The high water transmission coefficient allows for a rapid reduction of the internal temperature to 50-60°C, to slow down the temperature increase in the core and prevent excessive heating of the chilling rooms.

Immediately after pre-cooling, the product must remain in the chilling room for a minimum of 24 hours before being removed from its mould and a minimum of 48 hours is required before dispatch, in order to make sure that the colour and the other organoleptic properties of the cooked meat product have stabilised. At the very least, it must be made sure that the thermal centre of the ham product reaches temperatures of below 4°C. In products of a certain quality, and above all those containing a layer of skin or fat, changes have been detected in the oganoleptic properties during the period subsequent to cooking. Put simply, it could be said that the product 'settles', giving rise to a softer texture and better development of aroma. It is therefore recommended to wait an optimum period of time, depending on the product, before proceeding to dispatch.

Final preparation

Those products which have suffered cooking loss, with the exception of those smoked in permeable fibrous casing or products to be sold in slices, must be removed from their moulds and vacuum packed (thermosealed or clipped).

Because this always involves some handling of the product, extreme care should be taken to reduce to a minimum the unavoidable recontamination the product undergoes. This contamination becomes evident after some time in the

Chart 1

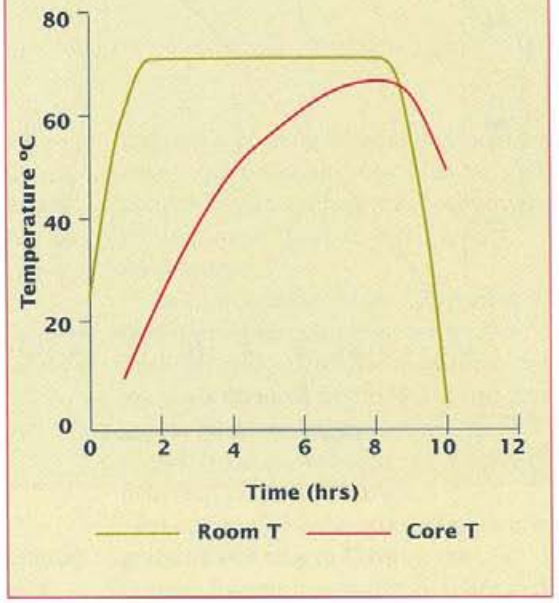


Chart 2

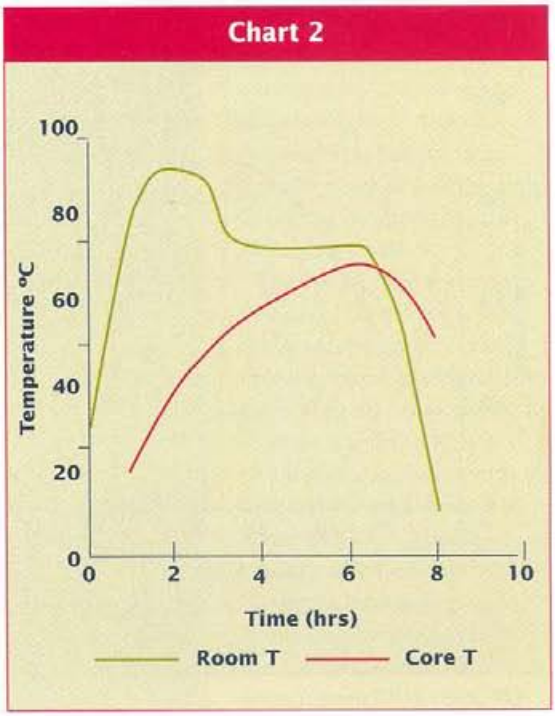


Chart 3

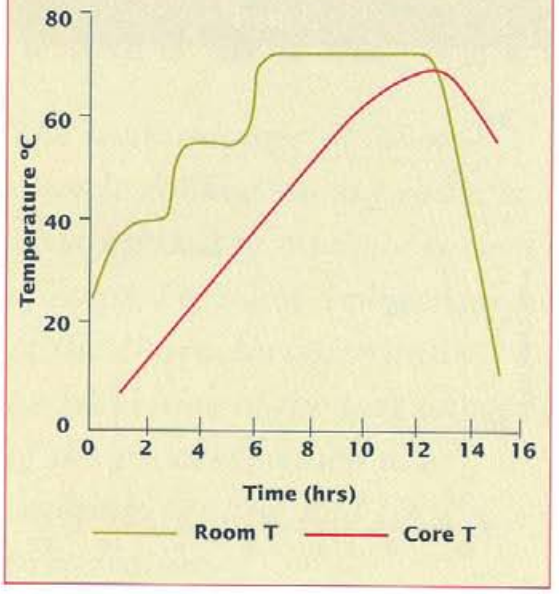
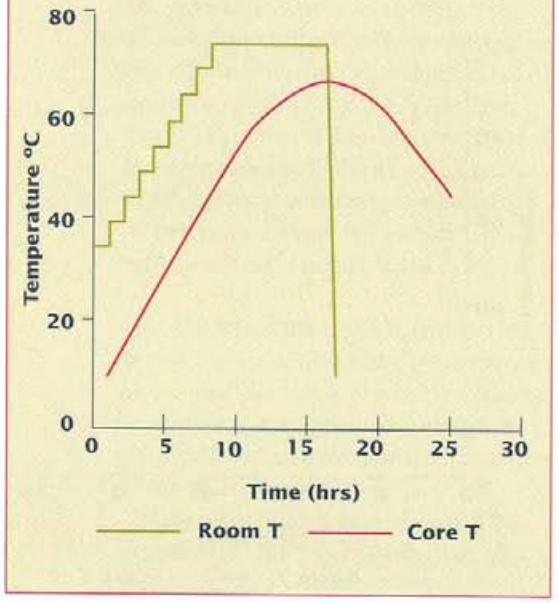


Chart 4



appearance of juices in the bag or final packaging. In some countries, manufacturers try to prevent this phenomenon by adding gelatin, by bathing the piece in solutions of preservative substances, by means of a superficial roasting of the piece; or by the application of ultraviolet radiation (UV), etc.

In recent years, a lot of work has been done on this subject, leading to the conclusion that the most efficient method is thermal processing (pasteurisation or sterilisation) of the product surface once it has been repackaged, regardless of whether or not gelatin is added. This method gives the finished product a shelf life that is clearly longer than products processed with the other above-mentioned methods. However, the final shelf life will depend on, as in all thermal processing, the relation between processing time and temperature to which the product is submitted. For conventional pasteurisation processes at atmospheric pressure, the minimum time must be that necessary for the temperature to penetrate some 4-5 mm into the meat surface.

This final preparation phase is unnecessary in those products cooked in their final packaging (cook-in) that have not exuded juices during the cooking process.

Cook-in technology is a sophisticated technology that requires rigorous control and care in all phases of the process, with great technological know-how and proper selection of the machinery. The advantages offered by this system, including extended shelf life of the finished product and increased profitability, make cook-in technology a very attractive option for the meat industry.

Finally, regardless of whether the process used has been cook-in or the product has been repackaged, it must be stored in a chilling room (between 2 and 4°C) and in darkness until its final arrival in the hands of the consumer.

Conclusions

The attainment of a technologically correct cooked meat product is not the fruit of chance. In this article we have shown the importance of thermal processing, cooling and final preparation in achieving this goal. In any case, this final technological effort will not be of any use unless it has been preceded by a careful selection of raw material as well as proper processing and strict control of each and every previous phase (from the preparation of the brine to the moulding of the matured meat).

This correct processing and rigorous control will help, without doubt, the meat manufacturer to obtain a high quality product while minimising all risks. **MI**