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## SLICE CURING OF BACON

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Most of the bacon produced in Gt. Britain - and by other countries for export to the British market - is Wiltshire bacon, that is bacon cured as whole sides. There are various modifications of the process in existence but essentially it consists of injecting into singed sides a brine containing, apart from common salt, nitrate and some nitrite. Small quantities of such sides would be dry cured, but the usual procedure is to immerse the sides in a cover brine of salt, nitrate and nitrite kept at 3° - 4°C. After 5 to 7 days the sides are removed from the tanks, allowed to drain and mature for about ten days. The bacon may then be despatched for consumption as "green" bacon or the cured sides may be smoked, depending on the preference of the local market.

The main drawback of this process is the long period of about two weeks required to produce the bacon, the necessity of keeping extensive curing rooms at a controlled low temperature and, last but not least, the uneven distribution of salt in the bacon.

The Wiltshire bacon cure is a traditional process, and scientific investigations have started to cast some doubt on some beliefs usually held by the trade.

Thus the production and maintenance of a good Wiltshire pickle was treated as an art and the possession of a sometimes years old pickle was considered a great asset. It was realised that the main role of bacteria in the curing brine was the reduction of nitrate to nitrite, required for the formation of cured meat colour, but bacteria were thought to be responsible for at least part of the flavour of bacon. This question has not yet been sufficiently investigated to provide a definite answer, but it has been the experience of the authors that very satisfactory bacon can be produced using almost sterile pickles. The uneven distribution of salt in a side of bacon is due to the slowness with which brine diffuses through the tissues, hence the need for a period of maturing. It has also been shown that the uniformity of salt distribution is correlated with the number of pump stitches per side. The possibility of obtaining a more uniform product, and possibly in a shorter time by curing smaller pieces of meat down to individual slices, has been considered occasionally but only recently has such a process been developed as a commercial operation.

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An interesting approach to this problem was made by Betty M. Watts, Who described her experiments in a paper published in 1956 (Food Technology, February 1956, p.101). She found that by dipping sliced raw pork into curing brines containing sodium chloride, sodium nitrite, Sodium ascorbate and liquid smoke and then freezing the meat a baconlike product was obtained. However, this process is still comparatively slow as several days are required for the development of colour which has to take place in the frozen state. The colour thus Obtained is not the typical colour of cured meat but that of raw pork meat and only during a subsequent cooling process does the cured meat colour develop. Thus the process is still comparatively expensive, Owing to the necessity of maintaining packs of the sliced and cured Product for days at the temperature of -17°C. The addition of sodium ascorbate to the brine further increases the cost and might not be entirely beneficial, as in a previous paper Watts had shown that ascorbic acid might accelerate rancidity in the absence of certain Proprietary liquid smoke whose use in Gt. Britain at least might be illegal.

The process which the authors wish to describe avoids the various shortcomings of the Watts process, has now been developed as a commercial <sup>operation</sup> and is covered by various patents.

The starting materials for the process are rectangular blocks of Meat obtained by deboning the middle portions of sides of pigs. These Cuts of meat are then divided so as to provide blocks of pork Corresponding to the usual types of streaky or back bacon. To obtain firm slices of meat, as required for the process, the blocks of meat are preferably chilled to about  $-2^{\circ}$ C. The meat is then sliced in such a manner as to form shingles and the shingles are moved from the slicing machine on to a moving belt which in turn deposits them on a metal grid. This is part of a carrier consisting of a supporting grid and an outer frame. When the supporting grid has been covered with slices of meat the outer frame is clamped over it. This carries an array of pins and this holds the meat in position. This frame has trunnions about which the carrier balances and which fit into slots in the conveyor which carries the meat through the brining tank.

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The composition of the brine can be varied depending on the desired degree of saltiness in the end product and other factors but, generally speaking, can vary between 10 to 32% weight/volume of salt and the nitrite concentration can vary from 0.005 to 1% weight/volume of nitrite ions.

The temperature of the brine is not highly critical; it may be in the region of room temperature, considerably lower than room temperature (for example 0°C.) or even above room temperature, provided that undesirable effects such as excessive melting of the fat or denaturation of the protein are not produced.

The time of curing treatment may vary according to slice thickness, concentration and temperature of brine, but is of the order of minutes.

To quote an example, a batch of meat sliced to a thickness of 3 mm. was carried through the curing bath, containing a treating solution comprising 22% weight/volume of sodium chloride and 0.1% weight/volume of sodium nitrite; the temperature of the solution in the bath was 20°C. The time taken for the passage of the meat through the bath was 4 minutes.

After leaving the brine tank the meat is allowed to drain and, unless required for sale as green bacon, it is transferred - still clamped in place in the carrier - to the smoking plant. The smoke chamber is constructed in such a way that the carrier holding the slices of cured meat is initially subjected to a blast of air designed to separate the slices from one another and then to a current of smoke. At this stage the cured meat does not resemble either fresh meat, nor has it acquired the colour of bacon. It is, however, ready to be packed and it is essential for this process that this should be done in vacuum. The outer frame of the carrier with the anchoring pins is, therefore, removed. The shingled meat is divided into groups of slices of appropriate weight and each group is then enclosed in a bag of low permeability to oxygen which is then vacuum-sealed. In due course the holes made in the meat slices by the anchoring pins close up.

The bags of meat are now stored and the characteristic flavour and colour of bacon develop at room temperature within 4 to 8 hours after packing, and usually within 24 hours after packing if stored at 2 to 5°C.

It has thus been possible to shorten very considerably the time necessary for the manufacture of bacon and to obtain a more uniform Product, which has been found to be highly acceptable and of a keeping Quality comparable, if not superior, to that of vacuum-packed bacon Produced by traditional methods.