

Methods for reducing the numbers of bacteria on meat intended for canning

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The primary objective in canning is to ensure the destruction of all live organisms that may damage the nutritional value and the flavour of the product so that the keeping quality is substantially prolonged beyond what is normal for the untreated product. The more contaminated the products are before canning the more effective the methods of decontamination of the product must be, with increased risk of changing the flavour and the nutritional value of the product. Hence it is of supreme importance that the products arrive at the cannery as free from contamination as possible and I shall here mention a few methods that may be used to achieve this objective.

There are two requirements if a minimum contamination of meat intended for canning is to be achieved. 1) The cleaning of the factory, i.e. the cleaning of the machines, fixtures, and fittings, 2) The condition and treatment of the raw products. It is not of any use having a spotless plant if the raw materials delivered to the factory are badly contaminated, because the raw materials will then infect the plant in a very short time. The opposite conditions will, of course, produce the same result. For the cleaning of the machines, fixtures, and fittings, sulfonated media are used with water not below 70° C. If further disinfection is required hypochloride solution is used after cleaning with the water. It is generally accepted that it is the wooden fittings that present the greatest problems.

Experience has proved that manual cleaning in itself varies greatly and is, rarely quite satisfactory. If a jet-cleaner is available this is far more efficient for fittings used in trimming. It is of greatest importance that the output water in the jet-cleaner should never drop below 90° C. Further disinfection is not imperative. This procedure is very gentle with the wooden fittings.

Loose planks may be sterilised completely by scalding or boiling. This treatment may be undertaken either in a vat or a steam cabinet. This procedure is convenient and very simple. Occasionally the planks will warp because of the fierce heat treatment, but planks are available that will stand both boiling and the subsequent complete drying out without warping. If there is a possibility of changing the planks it will often prove expedient to do so in the middle of the day.

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In Denmark the workers of the slaughterhouses do the cleaning themselves during the last half hour before the end of the working hours. There is not the slightest doubt that the cleaning would be far more efficient if undertaken entirely by special teams of cleaners made responsible for the cleanliness of the factory. From the practical angle this is, however, by no means easy, because ample supply of boiling water and steam must be available throughout the hours of the cleaning operations. In addition it might be rather difficult to organize the work of the cleaners so that there is no interruption of their work.

Briefly, this gives the important points on how to organize the cleaning of the plant. We must now look into the handling of the raw materials.

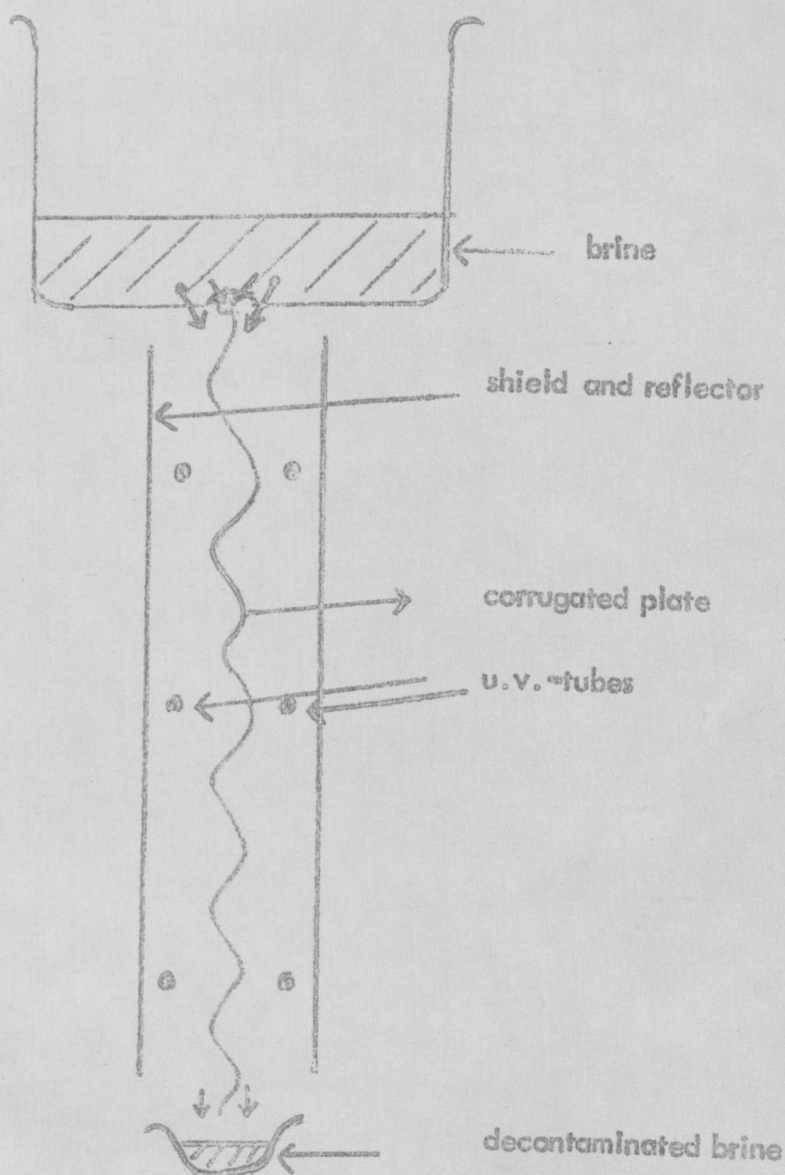
Many canneries have to buy their supplies of raw materials from outside sources, which often involves the supplies arriving in a badly contaminated condition.

In Denmark the canneries now subject the hams to multineedle pump, these are trimmed before salting and when badly contaminated hams are trimmed on the planks it is obvious that they will speedily infect the planks. We have seen examples of planks that after 2 hours of use showed a count of 1 million bacteria per  $\text{cm}^2$ . Before work commenced there had been less than 10 bacteria per  $\text{cm}^2$ . Since contamination of meat deriving from healthy beasts are chiefly a surface contamination, the removal of bones from fresh hams that are badly contaminated also presents a risk of infecting the inside of the ham. Accordingly it is of paramount importance to reduce the surface contamination of hams prior to boning. By scalding the hams for 5 or 10 seconds in a solution of 20% NaCl and 0,2%  $\text{NaNO}_2$  at approximately  $102^\circ\text{C}$  the surface bacteria count may be reduced from approximately 10 million per  $\text{cm}^2$  surface to below 1.000 per  $\text{cm}^2$ . If this method is followed, we avoid getting the grayish colour of the meat, which results if meat is scalded in ordinary water and no sign of scalding will be visible in the finished product. Further, this scalding will slightly raise the temperature of the meat, which facilitates the trimming.



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If the multineedle pump is used for salting, it will give high bacteria count in the circulating brine. Since the brine is rather expensive owing to its high phosphate content it is very poor economy to drain off the brine and let it run to waste. So I am going to mention an apparatus, which we have now developed in Denmark. The basic principle is that the returning brine passes through ultraviolet light. Here is a sketch of the apparatus:



The apparatus consists of a corrugated plate across which the brine runs subjected to rays from u-v tubes mounted 2 or 3 cm from the surface of the brine. With a throughput of approximately 100 litre per hour and 6 u-v tubes you reduce the bacteria count in one treatment to 1% of the original. If treated several times it may be reduced still further. The apparatus may be made on a larger scale to deal with greater bulk by increasing the measurements of the corrugated plate and the number of the u-v tubes.

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In the case of minced meat, i.e. sausage meat and luncheon meat, an excessive bacteria count in the finished products is due to the quality of the raw product and the additives. To adapt the production to the operation of the factory, trimmings are often stored for several days and frequently at temperatures that are too high. Scalding of the trimmings according to the above mentioned method may likewise give the product much better keeping qualities, but it is imperative that the cooling must be undertaken promptly after the scalding to preserve the hygienic gain achieved. For the cooling crushed dry ice or injection of liquid  $CO_2$  in the vats in which the trimmings are stored, is used. When I mention additives I am thinking chiefly of condiments (spices etc.) which may contain right up to  $10^5$  heat resistant spores per gramme. In Denmark there is a strong tendency now to use bacteria free condiments. The decontamination may be undertaken by heat sterilisation or by treatment with ethylenoxide, but decontaminated condiments are a great deal more expensive than ordinary condiments.

When workers handle the raw products, e.g. when slicing meat, it is of greatest importance that strict individual hygiene be observed to avoid infection of the product with Salmonella and Staphylococci. Notwithstanding this measure Staphylococci may often be found on the hands of completely symptomfree people since some are carriers of these bacteria without any pathological symptoms. For disinfection of the hands a lotion may be used containing 0,2% Rodalon, a quaternary ammonia compound. The disinfection of the hands begins with a thorough washing and for this a non-ionic detergent to which a 2% Rodalon has been added is used. After this washing the handlotion is rubbed well into the whole surface of the hands. It is of great importance that a non-ionic detergent be used for the cleaning of the hands prior to the application of the lotion because washing with ordinary soap will result in the binding of the active matter of the lotion. In the preparation of the hand lotion great importance has been attached to make it as attractive as possible, so that it is pleasant to use. The application of the hand lotion remains effective for about one hour and with the normal frequency with which the staff washes their hands 80 or 85 % of the staff will at any time have disinfected their hands within one hour. No Rodalon has ever been found on any meat, packed by a staff who have disinfected their hands with the lotion.

The present development in the canning industry indicates that the use of additives as for instance meat preserving media are more and more avoided. Accordingly low bacteria counts of meat to be canned must be achieved by improved hygiene throughout the entire process and the hygiene must be based upon physical methods. This is the actual basis for the development of the processes just mentioned.

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