DECONTAMINATION OF PIG CARCASSES

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Background

The continued global focus on food borne diseases can result in future requirements from the authorities or from consumers about a maximum level for pathogens in meat, which is so low that it will be impossible to satisfy it with known slaughter technology.

Optimum slaughter hygiene combined with decontamination could be the way to reduce the occurrence of pathogens, which are introduced during the slaughter process. Therefore the Danish meat industry has decided to evaluate the suitability of existing methods for decontamination of pork carcasses, although decontamination of fresh meat is not currently permitted in the EU.

Objective

It is the objective of the project to evaluate the suitability of existing techniques for pig carcass decontamination under the conditions prevailing in Denmark by pilot plant testing and to perform full-scale testing of the most promising method in a slaughterhouse.

The evaluation must consider effectiveness, influence on the external environment and on the working environment, statutory considerations, practicality and costs. After completion of the preliminary evaluations, the most promising technology will be tested under production conditions.

Methods

The project began in 1998 and is expected to be completed in 2000. It is carried out in two stages:

1. Evaluation of a number of methods and selection of the most promising technique.
2. Acquisition of equipment and full-scale testing in a slaughterhouse.

During stage 1, decontamination with hot water and with various chemical compounds was carried out in pilot tests. Decontamination with steam was not tested in the pilot tests, but examined via studies in the field and in the literature.

In stage 2, the most promising method will be evaluated in a full-scale test at a pig abattoir.

The pilot tests were carried out in a test cabinet developed by the Institute using slaughter warm loins as test objects. The test cabinet was installed at the Danish Meat Research Institute. It was a closed cabinet with a meat hook to suspend the test object. Eight jets provided by Spraying Systems Co. (ProMax Quick FullJet, Standard spray tip 2.9 gpm) were spraying directly onto the test object Attached to the cabinet were a liquid reservoir of 60 litres, a heat exchanger and a circulation pump. The decontamination liquid was thus maintained at a constant temperature and recirculated via the heat exchanger into the cabinet under a pressure of 1,5 bar.

The treatment time was 10 seconds measured from opening to closing of the jets. Five pork loins were treated in each test.

Microbiological sampling: Swab sampling was made immediately before and after the treatment by swabbing 100 sq. cm on each of the rind and meat/bone faces. Swabbing was done with gauze pads moistened with dilution fluid (NMKL No 144, 1992). The samples were examined for Aerobic micro-organisms (NMKL No 86, 2. ed., 1986) and *Enterobactericeae* (NMKL No 144, 1992).

Organoleptic assessment: The loins were assessed for colour and appearance immediately after treatment and after 24 hours chilled storage. The purpose of the latter assessment was to consider a possible regeneration of the colour after the treatment.

Results and discussion

Investigations in the first stage of the project showed that it is possible to reduce the number of bacteria on pigmeat by using physical or chemical decontamination. It was also made clear that the maximum reduction in total count is likely to be 1-2 log units, figure 1 . For *Enterobacteriaceae*, which indicate the effect on Gram-negative pathogens, a reduction of up to 2 log units is achieved.

The effect of treatment with hot water was promising for decontamination of pigmeat. At 80°C the aerobic count was reduced with 1-1,5 log-units. At 65°C the effect was just measurable, but no effect was found at 50°C. The lower temperatures were examined, to establish whether the effect was caused by rinsing off the organisms or by heat inactivation.

Investigations with chemical decontamination in the cabinet showed that counts can be reduced with 1-3 log-units using lactic acid or acetic acid at an application temperature of approx. 50°C.

Enterobacteriaceae: The counts for the untreated samples for *Enterobacteriaceae* were low, approx. 10 CFU per 100 sq. cm for the meat/bone faces and approx. 200 CFU per sq. cm for the rind faces. After treatment the level for the samples treated at 65 and 80°C was below the detection limit (<10 CFU per sq. cm). This means a minimum reduction on the meat/bone face of 1 log unit and on the rind face of 2 log units at both temperatures.

Colour change on fresh pork after decontamination with hot water: A possible organoleptic alteration of the fresh meat is an important factor for the suitability of the method in production. In order to achieve a reduction in the bacterial count, it is necessary to apply temperatures, which will alter the surface colour of the meat. The available literature has in some cases questioned whether pigmeat colour can be regenerated in the same way as beef colour, which is investigated thoroughly.

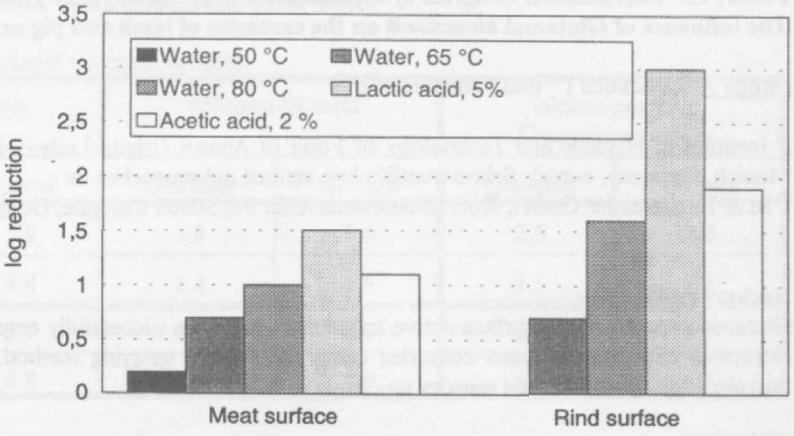

Figure 1: Log reduction in aerobic count after treatment of meat and rind surfaces on pork loins immediately after treatment. log reduction is calculated as mean log counts of five untreated minus mean log counts of five treated samples.

The pilot tests showed that temperature and time influences the colour immediately after treatment. But with the correct level of these factors it is possible to decontaminate pigmeat with hot water and achieve a satisfactory appearance after chilling.

At both 65 and 80°C a weak greying took place immediately after treatment, but the original colour regenerated after chilling. At both temperatures one could observe some protein coagulation at the meat surface even if the colour had regenerated. Fat, rind and membranes did not change appearance. At 80°C treatment times of more than 10 sec and thus a greater increase in product temperature resulted in a considerable colour deterioration. Treatment with 5% lactic acid resulted in irreversible discolouration of meat surfaces.

With the results, which have been obtained in stage 1, it is expected to be possible with hot water or with organic acids (max. 2.5%) to achieve a 1-2 log reduction in the level of bacteria on pig carcasses without irreversible discolouration of meat surfaces. However it is expected, that it will be easier to get acceptance from authorities and consumers to use hot water.

Full-scale testing

The Australian designed "STEER CLEER" equipment has been purchased for the full-scale test. This equipment has been selected due to its method for water application onto the carcasses and the water treatment system for the recirculated water.

Conclusions

Decontamination with hot water at 80°C is expected to be the best method for Danish conditions. The balance between effective bacterial reduction and reversible discolouration is achieved by controlling treatment time and water volume.

It is expected to achieve a reduction in aerobic count of 1-2 log units and a reduction in the numbers of *Enterobacteriaceae* of up to 2 log units. The latter indicates the effect on Gram-negative pathogens. This means that decontamination must be considered a supplement to an already optimised slaughter hygiene in order to achieve the desired low level of pathogens. Decontamination with hot water or organic acids will not eliminate the consequences of a poor slaughter hygiene.