Decontamination of Pig Carcasses with Hot Water

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Summary: A test of terminal pig carcass decontamination with hot water has been carried out in full production scale using a commercial installation, which was purchased for the purpose. The numbers of E. coli on the carcasses were reduced by more than 2 logarithmic units as a result of the decontamination. The total reduction in the number of E. coli as result of decontamination and carcass chilling was additive, and was more than 2.7 logarithmic units. Based on the available knowledge about the number of Salmonella on contaminated carcasses, it is expected that the combination of decontamination and carcass chilling in more than 90% of the cases will be able to reduce Salmonella on contaminated carcasses to levels below the detection limit. This has been confirmed by decontamination of carcasses from Salmonella-infected herds, where Salmonella were found only on 44 of 6045 carcasses (0.73 %) after decontamination.

Introduction: With respect to pathogenic micro organisms, there is an increasing tendency towards introducing maximum permitted levels, which are so low that they are impossible to fulfil with the established slaughter technology. In this connection it could be relevant to implement terminal carcass decontamination. A major theoretical and practical evaluation has documented that decontamination with hot water is the most promising technique regarding bacterial reduction and economics. A test of terminal pig carcass decontamination has therefore been carried out in full production scale using a commercial installation, which was purchased for the purpose.

Materials and methods: The decontamination is carried out in a cabinet, where carcasses, hanged upon gambrels and conveyed on an overhead rail, are showered with hot water. The decontamination is carried out as the last process on the slaughter line prior to carcass chilling in a blast-chilling tunnel. The decontamination cabinet is connected to a water treatment unit, in which the water is held for 3-4 minutes at 75°C prior to heating to 79-81°C and subsequent transfer to the cabinet. In total 27 m³ of water is passing through the cabinet per hour. At a slaughter-rate of 375 pigs per hour, each carcass is treated 15 seconds in the cabinet. The selected process parameters were established in a preliminary test based on a simultaneous evaluation of the bacterial inactivation and a visual control of the carcasses. The process parameters were selected to ensure that the meat colour was just reversible. The colour reverted during carcass chilling. However,
one area in particular (the meat surface at the sternum) had a somewhat greyish appearance due to a too severe heat treatment. In spite of this, the severe treatment of this area was maintained due to the likelihood of the area being contaminated with pathogenic organisms. Next to installation of the equipment for full scale operation, it was investigated how much the numbers of *E. coli* (NMIKL no. 147, 1993, incubation for 48 hours at 37°C) on the carcasses were reduced. Samples to be examined for *E. coli* have been taken from left and right sides of the same carcasses before and after decontamination. There has been alteration between right and left side before respectively after decontamination. When carcass chilling (approx. 24 hours after slaughter) was completed, further samples have been taken from decontaminated and not decontaminated carcasses. All samples have been taken from half carcasses by swabbing with one gauze swab wetted in saline water (0.9% NaCl and 0.1% peptone). The following areas on each half carcass have been swabbed: the pelvic duct, the medial face of the hind leg including 5 cm rind and the belly cut plus sternum including 5 cm rind, in total approx. 1400 cm². The selected areas are positions, where pathogenic contamination is likely, if the slaughter hygiene is inferior.

Bacterial counts are logarithmically transformed prior to statistical calculations. In cases where data sets contain counts below the detection limit, the calculation of means and standard deviations and the significance calculations are carried out with "proc lifereg" (SAS Institute); this includes an assumption that the log-transformed bacterial counts, which form the basis for a mean, are normally distributed. The probability of this has been controlled by using "proc univariate" (SAS Institute). If no other information is stated in the text, the commented differences in bacterial counts are significant (p<0.001).

**Results:** The results for *E. coli* are shown in figure 1. As can be seen, the inactivation effects of decontamination and blast chilling are additive, and the total reduction was more than 2.7 log-units. The effect of decontamination alone was more than 2 log-units.

**Discussion and conclusion:** It is expected that the combination of decontamination and carcass chilling in more than 90% of the cases will be able to reduce *Salmonella* on contaminated carcasses to levels below the detection limit.

This is based on the available knowledge about the number of *Salmonella* on contaminated carcasses and assuming conservatively, that the thermal inactivation of the commonly occurring *Salmonella* serotypes is similar to the thermal inactivation of *E. coli*. 
The results have been confirmed by decontamination of carcasses from *Salmonella*-infected herds, where *Salmonella* were found on only 44 out of 6045 carcasses (0.73 %) after decontamination when sampling from 1400 cm².

![Graph showing the mean per sample log count for different groups and dates](image)

**Figure 1:** *E. coli*, mean per sample. Data from three sampling days. "Bef. dec." and "Aft. dec.": Samples from the same carcasses, alternately right and left sides, taken immediately before and after decontamination. "Aft. chil.-dec." and "Aft. chil.+dec.": Samples taken after completed carcass chilling without and with previous decontamination from carcasses slaughtered the previous day. n=50 per column except for sampling 4 July before decontamination where n=49, sampling 4 July before decontamination where n=48 and sampling 5 July (slaughter 4 July) after chilling where n=41.