Hot Water Rinse

FOOD SAFETY TECHNOLOGY SUMMARY	
Status	Currently available
Location	Post slaughter
Intervention type	Surface treatment of carcasses, primals, trimmings
Treatment time	10-15 seconds at 75-85°C
Effectiveness	Limited efficacy before hide removal, very high efficacy after hide removal (1-3 log units)
Regulations	No restrictions, but the use of water on carcasses is discouraged in the EU
Likely cost	Depending on plant throughput from A$500,000 to A$1 million+
Value for money	Fair to good
Plant or process changes	Requires space that few abattoirs would have available
Environmental impact	High effluent loading High water use – recirculation may be necessary
OH&S	There may be risk of scalding Excess moisture on floors (e.g., from run-off post treatment) can cause slipperiness
Advantages	Can be used in combination with chemicals for greater effect, and can be used at various stages of the dressing process
Disadvantages or limitations	Product surface bleaching is evident immediately following treatment, but colour recovers with time Using high pressure sprays may drive water into the surface of the fat layer, rupturing connective tissue Condensation may be an issue

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Hot water/steam pasteurisation can be applied during slaughter in a number of different forms; either as a whole carcass wash (either pre- or post-evisceration), or to specific areas of the carcass. Application can be by spray (high or low pressure, manual or automatic), by deluge in a cascade or by immersion (more applicable to poultry or small cuts of meat).

Hot water treatment systems are installed in Australian plants. From the cost analysis performed by Texas A&M University some years ago for the Meat Research Corporation, we estimate that for a plant killing around 70-100 heads per hour, the fixed cost of a hot water treatment, preceded by a warm water wash, is approximately A$400,000-500,000. This, together with the variable costs (water, steam, labour etc.) gives a total cost of around A$0.60-0.70 per carcass.

Hot water as an intervention step has been extensively researched and a number of automated cabinet designs are in use around the world. Sheep and beef sides are treated for up to around 15 seconds with 75-95°C water, with reductions of up to 3 log units of pathogenic and spoilage bacteria being reported. A review by Loretz *et al.* (2011) reported reductions from 0.3–2.7 log units in naturally occurring levels of aerobic bacteria.

Heat kills bacteria mainly by inactivating the most sensitive vital enzymes for bacterial life, and a 95°C spray for 10 seconds raises the carcass surface temperature to 82°C (Barkate *et al*., 1993). Sprays of 95°C for 5 seconds at 165 kPa from a distance of 12.5 cm gave reductions of up to 3 log units in total coliforms, thermotolerant coliforms, *S.* Typhimurium and *E. coli* O157:H7 (Huffman, 2002), although maintaining such a high delivery temperature may not be easy. Ultimately, the greater the temperature of the water applied to the carcass, the better the overall food safety would be expected. For example, 80°C sprays reduced the total plate count of lamb carcasses by <1.0 log units (Kelly *et al*., 1981), 74°C is better than 35°C, and 1889 kPa is better than 276 kPa for removing visible contamination and *E. coli* on beef tissue (Gorman *et al.*, 1995). Scientific studies showed highly variable results, which might be due to differences in initial microbial load, microbial attachment or specific organisms studied. Microbial attachment increases with time from contamination, and results also vary depending on the tissue sampled, be it fat, muscle or connective tissue.

The USDA/FSIS acknowledges that there are significant scientific evidence showing that hot water (>74°C) produced a sanitising effect on carcasses (USDA/FSIS 1996). It has also been reported that hot water (74°C) spray-washing applied pre-evisceration was more effective in reducing contamination of beef tissue than solutions of 2% acetic acid (Bosilevac, *et al.,* 2006). Furthermore, Yoder *et al.* (2010) concluded that higher water temperatures, longer application times, and shorter spray distances would be more effective in removing pathogens from inoculated beef surfaces.

Hot water treatments remove faecal material and improve visual appearance of the tissue as required by the USDA 'zero-tolerance' policy. The position of the intervention on the chain is important – washing carcasses immediately after dehiding may inhibit further attachment of bacteria later in the process (Dickson, 1995). Hot water applied before any other washings gives a mean reduction in total count of 1.3 log units compared with a mean reduction of 0.8 log units if the hot water intervention is applied after a cold water wash (Barkate *et al.*, 1993).

Immersion in hot water is effective in removing bacteria from a meat surface – 10 seconds at 60°C resulted in a 1 log reduction in inoculated organisms, while 10 seconds at 80°C gave greater than 2 log reduction (Smith and Graham, 1978). However, exposing meat in an immersion tank may result in weight gain, and the product would have to be labelled as having added water. When researchers tried to decontaminate beef trimmings by immersion in hot water and lactic acid prior to grinding - 95°C for 3 seconds – they achieved 0.5 log reduction in *E. coli* and 0.7 log reduction in *S.* Typhimurium, but the trimmings gained 1.31% in weight during treatment (Ellebracht *et al*., 1999). Flooding the tissue by immersion or prolonged deluge with high temperatures should achieve high temperatures on and throughout irregularly shaped cuts or carcasses (Sofos and Smith, 1998), and investigations of small-scale hot water immersion of packaged meat products found good reductions in *L. monocytogenes* in wieners and beef sticks (Ingham *et al.*, 2005). The appearance of the wieners was enhanced, but that of the beef sticks deteriorated after 1 minute in boiling water.

Spraying may not achieve the desired temperatures at the contact surface and may generate condensate and aerosols, but may remove visible contamination. Low pressure spraying would give higher tissue temperatures than high pressure, as it allows for a longer contact time, but high pressure is more able to remove visible contamination. The disadvantages of hot water sprays include occupational health and safety issues for operators, possible visual colour effect on meat, and penetration of bacteria into the tissue, depending on the pressure of the sprays used. Hot water treatment can cause a cooked/bleached appearance, depending on the treatment time and temperature, but the discolouration is usually unnoticeable after a few hours of chilling (Castillo *et al.*, 2002).

Proponent/Supplier Information

Wash cabinets are built to order by companies such as Food Processing Equipment (FPE).

Food Processing Equipment (FPE).

878 Main North Road

Pooraka South 5095 Australia

Ph: 1800 882 549

Fax: 08 8262 5700

Website: http://www.fpe.net.au/home.html/

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