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 logs).
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 use 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, 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 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 s with 75-95°C water, with reductions of up to 3 log of pathogenic and spoilage bacteria being reported. Heat kills bacteria mainly by inactivating the most sensitive vital enzymes for bacterial life, and a 95°C spray for 10s raises the carcass surface temperature to 82°C (Barkate *et al*. 1993). Sprays of 95°C for 5s at 165 kPa from 12.5cm gave reductions of up to 3 log in total coliforms, thermotolerant coliforms, *Salmonella* Typhimurium and *E. coli* O157:H7 (Huffman 2002), but 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 result. For example, 80°C sprays reduced the total plate count of lamb carcasses by <1.0 log (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 show very variable results, which may be due to differences in initial microbial load, microbial attachment, specific organisms studied. Attachment would increase with time from application, and results would also vary depending on the tissue sampled, be it fat, muscle or connective tissue.

One researcher found that hot water (74°C) spray-washing was more effective in reducing contamination of beef tissue than solutions of 2% acetic acid, and the USDA/FSIS acknowledges that significant scientific evidence exists to conclude that hot water (>74°C) will produce a sanitizing effect on carcasses (USDA/FSIS 1996).

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 washing gives a mean reduction in total count of 1.3 log compared with a mean reduction of 0.8 log if the hot water intervention is applied after a cold water wash (Barkate *et al.* 1993).

Immersion in hot water is effective at removing bacteria from a meat surface – 10s at 60°C gave 1 log reduction in inoculated organisms, while 10 sec at 80°C gave greater than 2 log (Smith and Graham 1978), but exposed meat in an immersion tank may gain weight, which is not permitted under USDA-FSIS or AQIS legislation. When researchers tried to decontaminate beef trimmings

by immersion in hot water and lactic acid prior to grinding - 95°C for 3s – they achieved 0.5 log reduction in *E. coli* and 0.7 log reduction in *Salmonella* 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 *Listeria 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).

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 head 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.

Proponent/Supplier Information

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

Food Processing Equipment (FPE).

Contact: Shaun Frederick

Address: 878 Main North Road Pooraka

South Australia 5095

Ph: 1800 882 549

Fax: 08 8262 5700

Email: shaunf@fpe.net.au

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

APV Australia (Invensys Companies)

National Sales & Service Centre

Ph. 1-800-100-278

Email: tony.harris@invensys.com

Website: www.apv.com.au

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Smith, M. G., Graham, A. (1978) Destruction of *Escherichia coli* and Salmonellae on mutton carcasses by treatment with hot water. Meat Science **2**: 119-128.

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