Steam Pasteurisation

INTERVENTION SUMMARY	
Status	Currently Available
Location	Post slaughter
Intervention type	Surface treatment of carcasses, primals or trimmings
Treatment time	10-15 seconds
Regulations	No restrictions, discouraged in the EU
Effectiveness	Reduced efficacy before hide removal, very high efficacy after hide removal (1-3 logs)
Likely Cost	Depending on plant throughput from A$500,000 to A$1 million+
Value for money	Fair to good
Plant or process changes	Steam cabinets require a large amount of space
Environmental impact	High effluent loading High water use – recycling may be necessary
OH&S	Run-off may make floors slippery Risk of scalding from steam pipes and nozzles
Advantages	Can be used with other interventions
Disadvantages or Limitations	Condensation may be an issue if cabinet nor well ventilated Gives surface bleaching initially, but meat colour recovers with time

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Steam at 100℃ has a much higher heat capacity than water at the same temperature, so if steam condenses on a surface, the temperature of that surface rises more rapidly than if it were water that was deposited on the surface. Steam droplets are far smaller than bacteria and steam can penetrate into the cavities on the surface, and it will condense onto any cold surface.

Steam pasteurisation *in vitro* gives significant reductions in *E. coli* O157 levels on artificially inoculated samples, but few studies have examined the effects on naturally contaminated carcasses in a commercial environment. A 1998 study found significant reductions in total aerobic plate count and *E. coli* counts on beef carcasses (Nutsch *et al.* 1998). A recent commercial trial showed significant reductions in *E. coli* and *Enterobacteriaceae* at sites where initial numbers were high, but it did not result in complete elimination of these bacteria (Minihan *et al.* 2003). Combining two treatments - steam condensation on meat surfaces and hot water immersion, particularly chlorinated hot water - has also been shown to effectively decrease the bacterial load on lamb (James *et al.* 2000).

Steam pasteurization for even a short (<15s) duration results in initial surface greying of carcasses, but after 24hrs chilling, the acceptable colour returns (Phebus 1996; cited in Huffman 2002). A system of rapid cycling of steam under pressure and vacuum cooling has been designed which can give a 1.9 to 2.5 log reduction in *Listeria* numbers on beef after treatment for 48 milliseconds at 121℃ (Morgan *et al.* 1996a; 1996b). Steam has also been used on processed meat products; flash steam heating under pressure followed by cooling by evaporation can give up to 4 log reductions in microbial populations with a 30-40s steam treatment time, without severely affecting colour or weight of beef frankfurter sausages (Cygnarowicz-Provost *et al.* 1994).

A steam pasteurisation cabinet for beef carcasses was originally designed by a consortium involving Kansas State University, Frigoscandia Equipment Group, Bellevue, and Cargill Inc. It uses a two-stage cabinet system, each “the size of a subway car” (Smith 1996). The first cabinet applies a blanket of pressurised steam, raising carcass surface temperatures to 90℃ in 10-15s, and the second spray-cools the carcass before chilling. Microbial reductions of 3-4 log have been reported using this equipment. Production of condensation is a concern if adequate space is not provided to ventilate the cabinet.

For steam pasteurisation, the fixed cost for an installation would be around A$650,000 and the total cost A$0.75-0.80 per carcass.

Environmental considerations

Steam production requires a fair amount of energy, and water, although condensate may be collected, treated and recirculated.

Proponent/Supplier Information

Steam pasteurisation cabinets were developed in the 1990s by Frigoscandia. Their agents in Australia are FMC Technologies. Other companies that meay be able to construct steam cabinets are Food Processing Equipment (FPE), or APV Australia.

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