## Steam Pasteurisation

### INTERVENTION SUMMARY

<table>
<thead>
<tr>
<th>Status</th>
<th>Currently Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Post slaughter</td>
</tr>
<tr>
<td>Intervention type</td>
<td>Surface treatment of carcasses, primals or trimmings</td>
</tr>
<tr>
<td>Treatment time</td>
<td>10-15 seconds</td>
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<tr>
<td>Regulations</td>
<td>No restrictions, discouraged in the EU</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Reduced efficacy before hide removal, very high efficacy after hide removal (1-3 logs)</td>
</tr>
<tr>
<td>Likely Cost</td>
<td>Depending on plant throughput from A$500,000 to A$1 million+</td>
</tr>
<tr>
<td>Value for money</td>
<td>Fair to good</td>
</tr>
<tr>
<td>Plant or process changes</td>
<td>Steam cabinets require a large amount of space</td>
</tr>
</tbody>
</table>
| 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 |
Steam Pasteurisation

Steam at 100°C 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°C (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°C 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 may be able to construct steam cabinets are Food Processing Equipment (FPE), or APV Australia.

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References


