

Steam Pasteurisation System for Red Meat Carcasses in Canada

In the framework of equivalence discussions during the EU-Canada Joint Management Committee (JMC) Meeting in October 2006, Canada raised the possibility of using steam pasteurisation (SP) on red meat carcasses.

SP is commonly used in the US and Canada as an intervention method to reduce contamination with *E. coli* O157 by applying pressurized steam to the carcass surface for a short time (15 sec./ 95° Celsius). To date, this USDA approved treatment is not in use in Europe.

The overall scope of this study is to verify the compatibility of this technique under existing Community legislation and to study the potential benefits of the use of the technique in the EU.

1. Chronology of actions about SP

Date	Occasion	Concern – Implemented action
October 2006	JMC EU – Canada	Canada raised the possibility of using SP on red meat carcasses.
29 March 2007	SANCO D4	The Commission provided Canada a list of concerns about SP and Canada replied on 21 June 2007.
30 August 2007	France, rapporteur in the Canada Potsdam group	France requested the views of Member States on SP.
10 September 2007	Canada Potsdam Group	Discussion on the possibility to accept steam pasteurised carcasses. Some Member States raised concerns.
16 October 2007	SCOFCAH, Biological Safety of the Food Chain	The Commission presented a summary of the views of Member States (MS) on SP.
9 November 2007	Working Group of the hygiene package	The Commission presented further elaborated data on SP also addressing the concerns of some MSs. The possibility for a fact-finding on-the-spot mission to Canada/North America was further discussed.
16 November 2007	SANCO D4	Canada was provided with the elaborated data and requested for further scientific clarification on SP. Also, the intention for the fact-finding mission was raised.
3 December 2007	EU – Canada co-chair conference call	A conference call between the co-chairs of Canada Agreement took place in order to further clarify the open questions concerning SP and the scheduled time for the intended mission.
13 December 2007	Canadian Authority (CFIA), SANCO D4	Canada confirmed the date for the intended mission that will take place in the week of 18-22 February 2008. The MSs interested in participating at this mission were informed about the date of the mission.
18-22 February 2008	Information gathering mission in Canada	Planned mission to Canada/North America in order to receive information on the experiences in the use of SP in practice and to discuss open questions on scientific data. Participants: Commission and MSs.

2. Issues for consideration and available scientific knowledge

The Steam Pasteurisation System (SPS) of Frigoscandia is a patented commercial procedure following the slaughtering process in order to reduce bacterial counts by applying pressurized steam to the surface of carcasses for a short time (15 sec./ 95 °C). This moving clamshell system has been developed and redesigned as a static chamber later in a consortium together with Kansas State University (Scientific work done by Phebus R.K. and Nutsch A.L.), Frigoscandia Equipment Group, Bellevue and Cargill Int. and has been approved by the USDA in 1995. Besides Frigoscandia, also the U.S./Canadian Chad Company offers similar pasteurisation systems.

Issue	Available Information	References / Remarks
General remarks		
Has the SPS-system been taken up in Europe?	No. There are no SPS installations in the EU. Neither operational expertise nor theoretical advice can be offered by Frigoscandia Europe.	Information by Steve Rowe, Key Account Manager, FMC FoodTech, Frigoscandia Europe
Where is this system actually used?	United States, Canada	Indirect information from cited references. Information might not be complete.
What are the overall benefits of this system?	To reduce the risk of exposure of the consumer to foodborne pathogens, particularly E. coli O 157.	Phebus R.K. et al., J Food Prot (1997) 60: 476-84 Corantin H. et al., Can J Vet Res (2005) 69: 200-07
What are the overall uncertainties regarding this system?	The lack of inherent scientific data on the reversibility of colour change and the organoleptic characteristics of this meat.	Science-based information is required from Frigoscandia.
Scientific data		
Does steam pasteurisation result in complete decontamination of bacteria?	No.	Factsheet Frigoscandia SPS® SC Steam Pasteurisation System. Minihan D. et al., J Vet Med (2003) 50: 352-56 Corantin H. et al., Can J Vet Res (2005) 69: 200-07 Retzlaff D. et al., Foodborne Pathog Dis (2005) 2 (2): 146-51
What's the average of bacterial reduction?	Reduction of at least 1 log ₁₀ CFU/cm ²	Gill C.O. and Bryant J., Meat Sci (1997) 47: 267-76 Minihan D. et al., J Vet Med (2003) 50: 352-56 Corantin H. et al., Can J Vet Res (2005) 69: 200-07

		<i>(studies based on naturally contaminated carcasses)</i>
	Reduction of 1.4 to 1.9 log ₁₀ CFU/cm ²	Retzlaff D. et al., Foodborne Pathog Dis (2005) 2 (2): 146-51
	Results on Frigoscandia Factsheet reveal a reduction of 3 log ₁₀ for TVC (total viable counts) and of 1 log ₁₀ for Enterbacteriaceae	Assumed sources: Nutsch A.L. et al., J Food Prot (1998) 61: 571-77 <i>(based on naturally contaminated carcasses)</i> Castillo A. et al., J Food Prot (1998) 61 (1): 19-25 <i>(based partially on artificially contaminated carcasses)</i>
Is this decrease equivalent to all species of bacteria (faecal indicator organisms and foodborne pathogens)?	Steam pasteurisation results in a decrease of faecal indicator organisms (Enterobacteriaceae / E. coli). Also, foodborne pathogens like E. coli O 157 and Salmonella spp. are reduced by this technique in a comparative way.	Gill C.O. and Bryant J., Meat Sci (1997) 47: 267-76 Nutsch A.L. et al., J Food Prot (1998) 61: 571-77 Minihan D. et al., J Vet Med (2003) 50: 352-56 Corantin H. et al., Can J Vet Res (2005) 69: 200-07 <i>(the only study known so far that examined either faecal indicator organisms or foodborne pathogens in parallel using naturally contaminated carcasses)</i>
Is this bacterial reduction the same on all locations of the carcass?	Microbial contamination does not affect carcass surfaces uniformly. The effect of steam pasteurisation is more effective on more contaminated sites. Furthermore, the inside round region of carcasses results in a smaller reduction of pathogens.	Sofos J.N. et al., J Food Prot (1992) 62: 140-45 Bacon R.T. et al., J Food Prot (2000) 63: 1080-86 Minihan D. et al., J Vet Med (2003) 50: 352-56 Castillo A. et al., J Food Prot (1998) 61 (1): 19-25
Does this steam pasteurisation enhance the growth of some bacteria after treatment?	This pasteurisation may indirectly contribute to the growth of some pathogenic microorganisms like L. monocytogenes (partial destruction of competing flora). In a certain analogy: the treatment of carcasses with hot water (75° Celsius/30 sec.) lead to slightly higher growth rates of surviving L. monocytogenes during a storage of 25 days than on untreated carcasses. Decontamination with hot water did not shift the predominant microflora in the direction of yeasts and gram-positive bacteria (lactic acid	Corantin H. et al., Can J Vet Res (2005) 69: 200-07 Koutsoumanis K.P. et al., J Food Prot (2004) 67(12): 2703-11 Van Netten P. et al., J Food Safety (1994) 14(3): 243-57

	<p>bacteria) as did acid treatments.</p> <p>During 21 days of storage at 4° Celsius, the growth of pathogenic bacteria inoculated on beef carcasses after hot water treatment was less suppressed than that of carcasses threatened with alkaline or organic acid washes.</p> <p>The storage condition after subatmospheric steam treatment (75° Celsius) for sliced beef is crucial. Best results to ensure no re-growth were achieved packaging and storing them under vacuum at 0 degrees.</p>	<p>Dorsa W. J. et al., J Food Prot (1998) 61(12): 1615-22</p> <p>Logue C.M. et al., J Appl Microbiol (2005) 98(3):741-51</p>
Is scientific data available on the outlined reversibility of colour change?	Small colour change (darker colour) after treatment observed measuring samples with a spectrophotometer.	Cygnarowicz-Provost M. et al., J Food Sci (1994) 59(1): 1-5
Will the ripening of meat be affected by this treatment?	No scientific data available.	Science-based information is required from Frigoscandia.
Is there any evidence available that organoleptic characteristics are the same after treatment?	No scientific data available.	Science-based information is required from Frigoscandia.
Does this treatment affect meat processing?	No scientific data available.	Science-based information is required from Frigoscandia.

3. Questions addressed to Canada on 16 November 2007 about SP

Further scientific data is requested on the following issues:

- It is still not clear if SP has a similar affect on all relevant pathogenic bacteria (like Salmonella, Campylobacter, Listeria etc.) because most studies are based on the elimination of E. coli O157:H7. Are there further studies available responding this question?
- Considering the work done by Corantin et al. (2005), the question arose, if SP enhances the growth of specific pathogenic bacteria after treatment, possibly because of a partial destruction of commensal bacteria. Therefore, we are interested in studies on the impact of interactions of microorganisms on the meat surface after SP.
- Further clarification is requested on whether the effect of SP is uniform regarding the whole carcass; available scientific data does not address this question sufficiently.
- Is scientific data available on the outlined reversibility of colour change?
- Will meat ripening be influenced by SP? Does this treatment affect meat processing? Have these issues been studied?
- Is there any evidence that organoleptic characteristics are the same after treatment? Is there for scientific data provided?

Technical questions:

- the time of the application of SP (e.g. immediately after slaughter or after a cooling step)
- the water quality in use and the possibility to reuse it after suitable preparation

- the installation of sufficient ventilation in plants in order to prevent condensation on carcass surface
- the implementation of periodical microbiological analyses on the efficiency of SP elaborated by the plant
- the frequency of failures of SP and the main causes thereof

Additional questions to be referred to CFIA:

- the different SP systems in use in Canada (possibly in combination with any other invention for food safety like treatments with organic acids etc.)
- the integration of functionality checks concerning SP during a supervision visit of plants using this technology and the appropriate parameters to clarify this

4. Compatibility of this technique with the European Legislation / Codex alimentarius

	<i>European Legislation</i>	<i>Codex alimentarius</i>
Can steam be used directly in contact with food?	Steam can be used directly in contact with food. It may not contain any substance that presents a hazard to health or is likely to contaminate food (Reg 852/2004 chapt. VII, para 5).	Steam used in direct contact with food or food contact surfaces should not constitute a threat to the safety and suitability of food (CAC/RCP 1-1969, Chapt. 5.5.3.)
Can steam be used in direct contact with meat?	Following the remarks above and considering Art. 3 Chapter 2 in Regulation 853/2004 food business operators which handle with food of animal origin shall not use any substance other than potable water. If steam corresponds to the requirements of potable water, its use in direct contact with meat is allowed.	Washing of the animal bodies at multiple steps in the dressing process, and as soon as possible after each contaminating step, reduces the adherence of bacteria to the skin which can minimise overall carcass contamination. (Washing after evisceration and post-mortem is also necessary for technological reasons, as this is the only method available to routinely clean carcasses before entry to the chilling process). Washing may be carried out by several methods e.g., spraying, immersion washing (CAC/RCP 58-2005, Chapt. 9.4, no. 123). The use of steam will therefore not be principally precluded.
Can steam be considered as potable water?	The requirements for potable water (i.e. water intended for human consumption) laid down in Council Directive 98/83/EC of 3 November 1998. To this category belongs also water used in any food-production in direct contact with food (Art. 2). Water intended for human consumption shall be free from any micro-organisms and parasites and from any substances which, in numbers or concentrations, constitute a potential danger to	Potable water should be, as specified in the latest edition of WHO Guidelines for Drinking Water Quality, or water of a higher standard (CAC/RCP 1-1969, Chapt. 4.4.1)

	<p>human health and meets the minimum requirements set out in Annex L of this Directive (Art. 4).</p> <p>As it is remarked in Reg 852/2004 chapt. VII, para 5, steam in a direct contact with food may not present a hazard to health or contaminate food. The requirements for steam used for direct contact to food and water intended for human consumption are considered to achieve the same food safety objective.</p>	<p>As it is remarked in CAC/RCP 1-1969, Chapt. 5.5.3 steam in direct contact with food should not constitute a threat to the safety and suitability of food. The requirements for steam used for direct contact to food and water intended for human consumption are considered to achieve the same food safety objective.</p>
<p>Might this steam pasteurisation after slaughter lead to an interruption of the cold chain?</p>	<p>The cold chain as remarked in Regulation 852/2004 Chapter IX, Paragraph 5 is intended for food that cannot be stored safely at ambient temperature. Fresh meat particularly belongs to this category of foodstuffs. When using this steam pasteurisation directly after slaughter, the cold chain has not yet started. Therefore, no interruption of the cold chain occurs.</p>	<p>Maintaining the cold chain is important for freshly slaughtered and dressed carcasses as remarked in chapt. 9.7 of CAC/RCP 58-2005. When using steam pasteurisation directly after slaughter, the cold chain has not yet started. Therefore, no interruption of the cold chain occurs.</p>
<p>Can meat that has been treated with this method still be considered as fresh meat?</p>	<p>Considering Annex I Chapter 1.10 of Regulation 853/2004 'Fresh meat' means meat that has not undergone any preserving process other than chilling, freezing or quick-freezing, including meat that is vacuum-wrapped or wrapped in a controlled atmosphere.</p> <p>Steam pasteurisation is not to be considered as a preservation method but as a method to reduce bacterial surface contamination (what is intended for food of animal origin, Reg. 853/2004, Chapter II, Art. 3) and therefore steam pasteurised meat can still be considered in principle as fresh meat (if no changes to the characteristics of the meat appear). See also draft legislation on decontamination of poultry (The Evaluation of Antimicrobial Treatments for Poultry Carcasses – Opinion of the Scientific Committee on Veterinary Measures relating to Public Health, adopted on 14-15 April 2003) Substances used for the removal of surface contamination will not affect the status of fresh meat.</p>	<p>Codex alimentarius (CAC/RCP 58-2005) defines 'Fresh meat' as meat that apart from refrigeration has not been treated for the purpose of preservation other than through protective packaging and which retains its natural characteristics.</p> <p>Definition of fresh meat does not preclude interventions for the purpose of pathogen reduction (Code of Hygienic Practice for Meat, CAC/RCP 58-2005).</p>

5. Information gathering mission to Canada from 18-22 February 2008

The visit will help to clarify technical questions, to receive information on the experiences in the use of the technique in practice and to further inquire on open scientific questions e.g. by visiting a research centre involved in the development of the technique.

The scope and the programme of the mission still need to be set up.