Alternative method for knife disinfection with INSPEXX 200 is more efficient than 82°C water

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Abstract

EU regulations require disinfection of slaughter-equipment with water of at least 82°C. However, according EU regulation 853/2004, an alternative system having an equivalent effect may be used when equivalence can be shown. Ecolab's Inspexx© 200 (Inspexx) is a solution containing a stabilised blend of peracetic acid, peroctanoic acid and other organic acids – is shown to be an equivalent alternative. It is applied in water at ambient temperatures and does not need to be rinsed after application.

A practical trial in a Dutch pork abattoir was performed to study whether Inspexx is adequately effective in disinfecting knives used at slaughter. The standard method of disinfection with water of 82°C is used as reference whereas Enterobacteriaceae and mesophilic aerobic counts are outcome variables. Knives are immersed in hot water or Inspexx for 0, 1, 10, 30 and 60 seconds respectively.

Results clearly show that Inspexx reduces bacterial contamination of the knives significantly faster (within 1 second) than hot water, which needs at least 10 seconds. It is therefore concluded that Inspexx 200 can be used more effectively for the disinfection of knives used at slaughter.

The outcome of this study confirms a previous efficacy study performed on slaughter equipment. The latter study, in combination with safety and toxicity studies are the basis for official approval of the national authorities of several European countries to apply Inspexx as an alternative method for disinfection of cutting tools during slaughter. In this paper, we show that Inspexx is therewith applicable under practical conditions and a more robust alternative for disinfection of cutting tools used in dressing. Moreover, it can also save water and energy as water needs not to be heated to 82°C. Henceforth, Inspexx does not only improve meat safety, but it will also save environmental resources.

Introduction

According regulation 853/2004 (EU, 2004) slaughterhouses ' […] must have facilities for disinfecting tools with hot water supplied at not less than 82°C, or an alternative system having an equivalent effect'.

The use of water of 82°C can result in the coagulation of protein and melts fats, so that it can disperse over the surface of cutting tools, this can support the forming of biofilms and thus provide salmonella favourable conditions to survive in the slaughter environment. And subsequently, the abattoir has an optimal temperature for salmonella to multiply. Research (Swanenburg et al., 2001) has shown that slaughterhouses can have a house **f**ora of specific salmonella strains.

Ecolab developed a product based on the mixture of organic acids with the active substances; peracetic acid (POAA) and peroctanoic acid (POOA). This solution is marketed under the name Inspexx© 200 and is currently used as such in Europe and North America (USA and Canada). In previous studies it is shown that Inspexx can serve as an alternative method for disinfecting slaughter-robots during production. By improving the hygiene of slaughter-robots the microbiological results of carcasses improved as well (Oorburg, Holtslag et al., in prep).

Here, we studied whether Inspexx can serve as an alternative disinfection system for knives and whether it provides better microbiological results relative to conventional hot water disinfection.

Materials and Methods

Before commencing, several application points are identified (e.g. Achilles tendon incision, evisceration). The first part of the study required testing of knives, 2 trials per 3 days. During the first three days the effect of 82°C water is tested, disinfection is performed in the conventional knife sterilisers placed at the respective application points. During the other 3 days disinfection with Inspexx is performed in a knife steriliser located centrally. Knives from 5 different positions in the

slaughter line, i.e tendon incision, , intestine removal (evisceration), kidney, rework station, and loosening of the head are sampled. Samples are taken from either side of the blade; without disinfection, after 1 second at 82°C and after 1 min at 82°C.
In the second part of the study; the intervals 10 seconds and 30 seconds are tested on knives from the tendon and evisceration position, and the intervals 0, 1 second and 60 seconds are partly repeated. In this test, contrastingly to the first part of the study, one side is sampled before disinfection whereas the other side is sampled after disinfection.
Knife blades are sampled with Rodac plates (VRBG- en PCA). Each plate (3cm2 surface) is pressed on either sides of the knife blade. The maximum countable number per plate is 90 cfu.
Plate Count Agar (PCA) plates are incubated for 72 ± 3 hours at 30°C ± 1°C to subsequently enumerate Total Viable Count (TVC). Violet Red Bile Glucose Agar (VRBG) plates for 24 ± 1 hours at 37°C ± 1°C to subsequently enumerate enterobacteriacea.
Inspexx 200 solutions are produced by means of a special dosing equipment. Verification of the concentration is performed by means of conventional iodometric (Redox) titration. 10 ml of the solution is acidified with 0,5N H2SO4. 1,0N KI after which 2,0% starch solution is added. This mixture is subsequently titrated with 1,0N Na2S2O3.

Results

The results of study 1 are shown in table 1. At 82°C after 1 second there is only a small reduction of TVC and enterobactericeae. Inspexx is already highly effective after 1 second.

Table 1: Total viable counts and enterobacteriaceae on knives after disinfection with hot water and Inspexx at different time intervals

Duration	82°C water n= 90	Inspexx n= 94
	Total Viable counts	
None	1,51±0,55	1,21±0,64
1 sec	1,34±0,69	0,19±0,39
1 min	0,01±0,06	0,003±0,03
	Enterobacteriacea	
None	0,57 ±1,07	0,56±0,74
1 sec	0,28 ±0,76	*GA*
1 min	*GA*	*GA*

counts expressed as log cfu/3cm² ± SD
GA = growth absent on all plates

The results of study 2 are shown in table 2. At 82°C, after 1 second, there is only a small reduction of TVC and enterobactericeae, and also at ten seconds disinfection is not fully effective. Inspexx is already highly effective after 1 second.

Table 2: disinfection with hot water at different time intervals

	82° C		Inspexx		
Time	**Before**	**After**	**Before**	**After**	**n**
	Total Viable Counts				
	Evisceration				
1 sec	1,87±0,18	1,71±0,53	1,59±0,68	0,61 ±0,65	10
10 sec	1,45±0,53	0,99±0,71	1,94± 0,04	0,11± 0,18	20
30 sec	1,48±0,42	0,10±0,21	1,68± 0,34	0,08 ±0,25	20
60 sec	1,64± 0,31	0,08±0,27	1,71 ±0,24	0,08 ±0,17	10
	Achilles tendon				
1 sec	1,95±0	1,96 ±0,0	1,78±0,0	0,63±0,61	10
10 sec	1,9±0,01	0,05±0,14	1,74±0,60	0,03±0,17	20
30 sec	1,86±0	0,12±0,43	1,96±0,0	0,0±0,20	20
60 sec	1,96±0	0,55±0,72	1,96±0,0	*GA*	10
	Enterobactericaeae				
	Evisceration				
10 sec	0,99±0,54	*GA*	0,75±0,62	0,04±0,16	15
30 sec	1,50±0,45	*GA*	0,71±0,41	*GA*	15
	Achilles tendon				
10 sec	1,55±0,41	0,07±0,19	1,68±0,44	*GA*	15
30 sec	1,67±0,27	0,07±0,21	1,83±0,17	*GA*	15

counts expressed as log cfu/3cm² ± SD
GA = growth absent on all plates

Discussion

The present results show that sufficient time, at least 10 seconds is crucial to achieve the required sterilising effect when using water at 82°C. This shows one of the problems slaughterhouses have at present, as it is difficult for employees during the daily routine to take sufficient time for disinfection, due to the high slaughter speed. Secondly, many slaughterhouses have problems in assuring the mandatory temperature of the sterilizers.

The present results prove that Inspexx is a better alternative for knife disinfection.

For Inspexx only 1 second immersion proved sufficient whereas dipping in hot water for 1 second did not have a significant effect. No significant difference between Inspexx and hot water is noticeable if immersion lasted 10 seconds or longer. As a consequence, Inspexx is highly effective in disinfecting knives, it is therefore more than equivalent to hot water.

Beside hygienic advantages Inspexx may also have sustainability advantages. Disinfection with hot water is expending high amounts of energy in order to bring and maintain water at the mandatory temperature. Secondly, hot water disinfection expends high amounts of water, as the sterilizers' temperature need to be maintained at a mandatory minimum.

High throughput of water at high temperatures often results in scaling, hence requiring higher throughput pressure and more energy consumption. Furthermore, high levels of humidity caused by hot water use results in condensation on walls, ceilings and other inaccessible areas which subsequently poses additional bacteriological risks.

Finally, it is common knowledge that use of hot water will result in coagulation of proteins on the cutting edges of knives causing bluntness of any cutting tool. Undoubtedly, this will require more effort from the employee to use his tools. Use of Inspexx does not result in coagulation of proteins on cutting edges hence, use of Inspexx prolongs use of knives.

Based on previous reports on efficacy (Oorburg, Holtslag et al, in prep), toxicological evaluations and safety assessments; the Dutch authorities have given permission for application Inspexx in slaughterhouses. This was followed by other EU member state authorities (for example Germany, Switzerland etc.).

Conclusion

Inspexx is highly effective in disinfecting knives; it is therewith more than equivalent to 82°C water. Besides improving hygienic quality, application of Inspexx can save water and energy.

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