Animal/Hide Washing or Dehairing

INTERVENTION SUMMARY	
Status	Currently available
Location	Post-slaughter – hide-on
Intervention type	Surface treatment of hide
Treatment time	10-30 seconds
Regulations	Restrictions apply – see relevant chemical
Effectiveness	Conflicting reports depending on chemicals used.
Likely cost	To set up water supply, pumps, chemical storage and effluent treatment for a plant of 500 head per day would be hundreds of thousands of dollars
Value for money	Other technologies likely to be more effective if applied after hide removal
Plant or process changes	Significant space would be needed for installation of baths or cleaning units
Environmental impact	Production of water effluent and chemicals Large amounts of water and energy would be required
OH&S issues	Chemicals would need to be properly stored and handled Concentrates and diluted chemicals may be irritant
Advantages	Reduces visible soil entering the process Cleaner skins allows slaughter personnel to keep their hands and tools cleaner Having a wet hide freshly washed may remove some of the loose hide hairs and reduce some of the contamination from individual hairs which have a zero tolerance score Has been used in the sheep industry to wash pelts prior to slaughter and is seen as a hygiene advantage
Disadvantages or limitations	Could stress animals if applied to the live animal, which would result in tougher meat (DFD)

Disclaimer

Care is taken to ensure the accuracy of the information contained in this publication. However MLA cannot accept responsibility for the accuracy or completeness of the information or opinions contained in the publication. You should make your own enquiries before making decisions concerning your interests.

Animal/Hide Washing or Dehairing

Chemicals can be used, as part of a wash step, to clean hides and fleeces before hide removal with the aim of lowering microbial and/or visible contamination. Compounds such as sodium hydroxide, trisodium phosphate, acidified chlorine (sodium hypochlorite with acetic acid), and phosphoric acid have been evaluated for this purpose. These chemicals do not have a neutral pH, and thus a water rinse is needed to remove the residual chemical and to minimise risks for plant personnel. Other combinations of chemicals can also be used to dehair bodies prior to skinning.

Hide or Fleece Washing

In cattle, the contact of the carcass surface with faecally soiled hide that had been washed prior to slaughter can result in a microbial load on the carcass surface similar to that resulting from contact with fresh faeces (Bell, 1997). Van Donkersgoed *et al.* (1997) found that although slowing line speed or shaving off dag could reduce carcass microbial contamination, this reduction was not statistically significant, but on a slow line, wet hides seemed to give slight increases in carcass coliform or *E. coli* counts. Strict sanitary dressing procedures including a cold water wash of cattle the day before slaughter and pre-chill decontamination of the resultant carcasses can result in reduced mean aerobic plate count and improved shelf life when compared to conventionally dressed cattle with no pre-slaughter wash (Dixon *et al,.* 1991). Arthur *et al.* (2007) also evaluated the effectiveness of a hide wash cabinet in medium-sized plants. The data indicated that a cold water wash, followed by a chlorine spray of 100 to 200 ppm reduced the prevalence of *E. coli* O157:H7 on the hide brisket from 35% to 13%. However, it has been reported that pre-slaughter washing alone might produce no statistically significant reduction in carcass contamination (Byrne *et. al.,* 2000). The authors also found that a 3-minute wash of dried faecal matter on cattle rumps reduced the levels of marker organism present, but had no statistically significant reduction in the microbial load of the resultant carcass.

Pre-slaughter washing of sheep is widely used in New Zealand (Biss and Hathaway, 1995), particularly in groups of sheep that have extensive faecal staining or smearing of the pelt, faecal material collected around the hind legs and/or excessive accumulations of mud or dust in the fleece. The pre-slaughter wash described by Biss and Hathaway (1995) involved an initial cold water (10°C) shower wash, with water directed up from floor level to the bellies, as well as from above. Clean lambs were showered for 2 minutes, and dirty lambs for up to 10 minutes. The wet lambs were then immediately forced to swim for approximately 1 minute in a trough of counter flow cold water, which was emptied and cleaned daily. After this, the lambs were allowed to drip-dry overnight. When lambs have been washed prior to slaughter, less visible contamination can be seen on the carcasses (Petersen 1978), but the microbiological counts can be up to 0.3 log higher than on lambs that have not been washed (Biss and Hathaway, 1996a). The detrimental effect of the pre-slaughter wash was found to be greater on carcasses derived from woolly lambs than from shorn lambs. Numerous swims could also have an adverse effect on sheep welfare – the muscle pH increases with greater number of swims, and the duration of the post-swim rest phase did not improve this (Petersen, 1983), and there is a highly significant increase in the prevalence of bruising in lambs that have been swum as compared with unwashed lambs (Petersen 1978). Wet animals moving from the bath to the drying pens were seen to slip and fall, or run into rails and gates because of the slippery surface of wet gratings underfoot. Sheep with excessive accumulations of faecal material around the anus generally undergo shearing of the affected perineal area ("crutching") prior to slaughter, but this has not resulted in significant improvements in carcass microbiology (Roberts, 1980). A New Zealand-based company, Klenzion Ltd, has developed a restrained washing unit for washing and drying sheep prior to slaughter, using quaternary ammonium compounds, marketed as Agwash™ and Agsan™. These chemicals are approved for use in Australia. However, the company has already been closed down.

Chemical Dehairing

The dehairing process after stunning and sticking results in visually cleaner carcasses and reduces the requirement for trimming faecal contamination. It occurs in a wash cabinet that uses a succession of chemical and water combinations (Schnell *et al.*, 1995). Scientific studies have shown variable results. In particular, Schnell *et al.* (1995) used a chemical solution of 10% sodium sulphide, water washes, and 3% hydrogen peroxide, in an in-plant commercial system, but found that this combination did not significantly reduce the naturally occurring bacterial load (i.e., total aerobic bacteria and *E. coli*) on carcases. By contrast, Castillo *et al.* (1998) used a similar chemical dehairing process but on small hide pieces (i.e., not applied to full carcasses) under controlled laboratory conditions, and found a significant reduction (5 log units) in the counts of aerobic bacteria, coliforms and *E. coli*, as well as artificially inoculated *S.* Typhimurium, and *E. coli* O157:H7. Despite those inconsistent results, Nou *et al.* (2003) ultimately demonstrated that chemical dehairing as part of a commercial operation involving other interventions, did contribute to a reduction in incidence of hide-to-carcass contamination with pathogens such as *E. coli* O157:H7.

The implementation of chemical dehairing has its draw-backs and may not be feasible for industry. A cabinet would need to be incorporated after stunning and shackling of the carcass and this would require an up-front capital investment. A current USA patented in-plant system would require a closed cabinet with an expected dwell time of almost 6 minutes (Schnell *et al.*, 1995). There would also be issues dealing with waste such as sodium sulphide generated, which could possibly be re-used, and processing of the hydrolysed hair, which could be used as fertiliser. The chemical would contact exposed tissue at the stick wound, so the area would have to be trimmed off, or the animal subjected to stun-kill, and bled after dehairing.

An alternative to dehairing all animals is to segregate soiled animals and pay more attention to these particular animals by reducing the line speed while processing and increasing the number of personnel attending these animals.

Sodium Hydroxide

Sodium hydroxide can be used as a hide wash intervention. Bosilevac *et al*. (2005) have evaluated a 1.6% solution, followed by a chlorinated (1 ppm) water rinse, in an on-line hide-wash cabinet. Results showed 2.1 and 3.4 log reductions in aerobic plate counts and *Enterobacteriaceae* counts respectively, and the prevalence of *E. coli* O157 was reduced from 44 to 17%.

The USA company, Cargill Meat Solutions has implemented hide washing systems in all of their plants. Cargill's choice of compounds to use in the automated hide wash cabinets involved consideration of cost, ease of implementation and efficacy. Sodium hydroxide at 1.5% was chosen as the wash because it does not lose activity, as acids often do, in a recirculating system using 1 ppm chlorine. In addition, as the carcass exits the cabinet, plant personnel can use a steam vacuum to remove excess liquid and loosened material along the hide opening pattern lines (Koohmaraie *et al.*, 2005).

Proponent/Supplier Information

EcoLab supply a number of different chemicals.

EcoLab Australia

2 Drake Avenue

MacQuarie Park, NSW 2113 Australia

Ph: 02 8870 8100

Fax: 02 8870 8680

Website: http://www.ecolab.com/

References

Arthur, T.M., Bosilevac, J.M., Brichta-Harhay, D.M., Kalchayanand, N, Shackelford, S.D., Wheeler, T.L., Koohmaraie, M. (2007) Effects of a minimal hide wash cabinet on the levels of *Escherichia coli* O157:H7 and *Salmonella* on the hides of beef cattle at slaughter. Journal of Food Protection **70**: 1076-1079.

Bell, R. G. (1997) Distribution and sources of microbial contamination on beef carcasses. Journal of Applied Microbiology **82**: 292-300.

Biss, M. E., Hathaway, S.C. (1995) Microbiological and visible contamination of lamb carcasses according to preslaughter presentation status: implications for HACCP. Journal of Food Protection **58**: 776-783.

Biss, M. E., Hathaway, S.C. (1996) Effect of preslaughter washing of lambs on the microbiological and visible contamination of carcasses. The Veterinary Record **138**: 82-86.

Bosilevac, J. M., Arthur, T. M., Wheeler, T. L., Shackelford, S. D., Rossman, M., Reagan, J. O., Koohmaraie, M. (2004a) Prevalence of *Escherichia coli* O157 and levels of aerobic bacteria and *Enterobacteriaceae* are reduced when hides are washed and treated with cetylpyridinium chloride at a commercial beef processing plant. Journal of Food Protection **67**: 646-650.

Bosilevac, J. M., Nou, X., Osborne, M. S., Allen, D. M., Koohmaraie, M. (2005) Development and evaluation of an on-line hide decontamination procedure for use in a commercial beef processing plant. Journal of Food Protection **68**: 265-272.

Byrne, C. M., Bolton, D. J., Sheridan, J. J., McDowell, D. A., Blair, I. S. (2000) the effects of preslaughter washing on the reduction of *Escherichia coli* O157:H7 transfer from cattle hides to carcasses during slaughter. Letters in Applied Microbiology **30**: 142-145.

Castillo, A., Dickson, J. S., Clayton, R. P., Lucia, L. M., Acuff, G. R. (1998) Chemical dehairing of bovine skin to reduce pathogenic bacteria and bacteria of fecal origin. Journal of Food Protection **61**: 623-625.

Dixon, Z. R., Acuff, G. R., Lucia, L. M., Vanderzant, C., Morgan, J. B., May, S. B., Savell, J. W. (1991) Effect of degree of sanitation from slaughter through fabrication on the microbiological and sensory characteristics of beef. Journal of Food Protection **54**: 200-207.

Koohmaraie, M., Arthur, T. M., Bosilevac, J. M., Guerini, M., Shackelford, S. D., Wheeler, T. L. (2005) Post-harvest interventions to reduce/eliminate pathogens in beef. Meat Science **71**: 79-91.

Nou, X., Rivera-Betancourt, M., Bosilevac, J. M., Wheeler, T. L., Shackelford, S. D., Gwartney, B. L, Reagan, J. O., Koohmaraie, M. (2003) Effect of chemical dehairing on the prevalence of *Escherichia coli* O157:H7 and the levels of aerobic bacteria and *Enterobacteriaceae* on carcasses in a commercial beef processing plant. Journal of Food Protection **66**: 2005-2009.

Petersen, G.V. (1978) Factors associated with wounds and bruises in lambs. New Zealand Veterinary Journal **26**: 6-9.

Schnell, T. D., Sofos, J. N., Littlefield, V. G., Morgan, J. B., Gorman, B. M., Clayton, R. P., Smith, G. C. (1995) Effects of postexsanguination dehairing on the microbial load and visual cleanliness of beef carcasses. Journal of Food Protection **58**: 1297-1302.

VanDonkersgoed, J., Jericho, K. W. F., Grogan, H., Thorlakson, B. (1997) Preslaughter hide status of cattle and the microbiology of carcases. Journal of Food Protection **60**: 1502-1508.