Organic Acids

INTERVENTION SUMMARY	
Status	Currently Available
Location	Post slaughter – carcass or packaging
Intervention type	Surface treatment of carcass, primals, offals
Treatment time	10-30 seconds depending on solution temperature
Regulations	Approved US and Australia, prohibited in EU
Effectiveness	1-3 logs reduction
Likely Cost	Could cost in the $100,000 to $300,000 range to install a cabinet
Value for money	If there is an existing wash cabinet, capital cost is low and may be good value – estimated cost of solution $1.70 per beef carcass
Plant or process changes	Spray cabinet will be required
Environmental impact	Disposal of chemicals may be an issue
OH&S	Acids are irritants, so careful handling is required Risk of inhalation of irritant Secure storage of the concentrate will be required
Advantages	Applied by spray or immersion Can be used with other treatment/technologies Much literature on efficacy Possible prolonged inhibition of microbial growth
Disadvantages or Limitations	When applying by spray, the airborne aerosols - particularly of acetic acid - can have a corrosive effect on equipment surrounding the spray cabinet Concerns about acid-resistant microorganisms

Organic Acids

Solutions of organic acids (1-3%) such as lactic and acetic acids are the most frequently used chemical interventions in commercial plants for both beef and lamb dressing. Many other organic acids, however, have been researched either separately or as a mixture for use in chemical washes, including formic, propionic, citric, fumaric, and L-ascorbic acid.

Organic acids have been shown to be most effective when applied as a warm (50-55°C) carcass rinse (Acuff 2005). Unfortunately, the corrosive effect on the equipment seems to increase as the temperature rises. There are conflicting reports as to whether there is greater bacterial inhibition by acetic compared to lactic or citric acid washes. Lactic acid (2%) was shown to reduce *E. coli* O157:H7 on beef carcass tissue by 3.3 log, and 2% acetic acid reduced it by 1.6 log (Ransom *et al.* 2003). These authors also found that lactic acid and acetic acid treatments on cheekmeat, using spray or immersion, resulted in 1.1 log reductions in total bacteria. The lesser reductions were attributed to the physical structure of cheekmeat which may protect microbes from the treatments. Other authors found that lactic acid was ineffective in decontaminating beef tissue under commercial conditions (Gill and Landers 2003). Organic acids (lactic, acetic, and propionic) have been reported to decrease populations of *E. coli* and other bacteria when sprayed on sheep/goat carcasses or used as a wash (Dubal *et al.* 2004; Ramirez *et al.* 2001).

The mechanism of action of organic acids on the microbial cell is not completely understood, but it is hypothesised that it is the undissociated molecule of the acid that is responsible for the antimicrobial activity. There is a lot of variability in the literature in terms of the cited reductions that can be achieved. This is mainly due to differences in the concentrations of the acids used by different researchers, the method of application, and the types of samples tested. There is also some evidence that organic acids may enhance the shelf life of modified atmosphere packaged product, mainly because they increase the lag phase of the microorganisms (Podolak *et al.* 1996).

In the US, organic acids are applied as part of a carcass wash pre-chill and can be applied at levels up to 2.5% of a solution (USDA/FSIS 2004). In addition, lactic acid is approved for use on beef carcasses, sub-primals and trimmings (i.e. pre and post-chill), offal and variety meats at levels up to 5% at temperatures not exceeding 55°C. Organic acids are not permitted under EU regulations, but the USDA has specifically approved lactic acid, acetic acid, and citric acid as antimicrobial agents in the final wash that is applied to livestock carcasses after trimming and inspection but before chilling (21 CFR 101.100 (a) (3): FDA 2003).

Hot carcass surfaces treated with organic acids often display some discoloration of tissue or fat surfaces. However, as with hot water pasteurisation, this often disappears or becomes less evident after chilling. There may be issues with meat surface discolouration, and operators may experience skin/eye irritation when acetic acid is used. Organic acids (acetic and lactic acid) have been evaluated as a method of sanitising beef carcasses during spray chilling. The studies found a significant (up to 3 log) reduction in total aerobic count and pathogen populations (Dickson 1991; Hamby *et al.* 1987).

In the literature, there is also mention of the possibility for the use of organic acids to alter the microbial ecology of meat plant environments and potentially that of the beef, and should be considered when selecting food safety technologies for meat (Acuff 2005). There are also concerns associated with using organic acids in that they may select for the presence of acid-resistant bacteria that may accelerate rates of product spoilage, increase undesirable effects on product appearance, and speed equipment corrosion (Gill 1998).

Approximate costs for organic acid spray in beef/pork processing plants (A$, adapted from Reynolds 2005)

Organic acid	*List price (200 litres)*	*Cost per unit (ml)*	*Cost per litre of solution*	*Cost per carcass**
Lactic Acid (88% food grade) *2% solution = 23 ml + 1 litres H_2O*	$ 1063.00	0.5¢	9¢	7¢ (pig) 14¢ (beef)

* eight litres of 2% lactic acid will treat approximately 10 pigs or 5 beef carcasses.

Proponent/Supplier Information

Wash cabinets may be installed by a number of companies such as APV, FPE or CHAD:

APV Australia (Invensys Companies)

National Sales & Service Centre
Ph. 1-800-100-278

Email: tony.harris@invensys.com

Website: www.apv.com.au

Food Processing Equipment (FPE).

Contact: Shaun Frederick

Address: 878 Main North Road Pooraka South Australia 5095

Ph: 1800 882 549

Fax: 08 8262 5700

Email: shaunf@fpe.net.au
Website: http://www.fpe.net.au/home.html

CHAD Company

United States

Contact: Rosey Hohendorf

Ph. (800) 444-8360

Fax: (913) 764-0779

E-mail: rosey@chadcompany.com

Website: www.chadcompany.com

There are many food acid-grade suppliers in Australia. One larger company is Swift Australia.

Swift Australia (Head Office)

1st Floor, 372 Wellington Rd,

Mulgrave, VIC 3170.

Ph: 03 8544 3100 Fax. 03 8544 3299

Website: http://www.swiftco.com.au

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