Gas Plasma

INTERVENTION SUMMARY	
Status	An emerging technology
Location	Packaging/retail
Intervention type	Surface treatment
Treatment time	Variable
Regulations	Not determined – technology very new
Effectiveness	5 log reduction
Likely cost	High capital outlay
Value for money	Good potential. However, if using air (i.e., O_2) as the gas, can be cost effective
Plant or process changes	Space would be required for installation of the equipment
Environmental impact	Energy is required, but no effluent produced
OH&S	The unit would require proper screening
Advantages	Can treat irregular surfaces. No chemicals or residues produced. The gases are ionised between the plates, and it is the gas that is in contact with the meat surface
Disadvantages or limitations	Surface penetration only Consumer perception may be poor because of a perceived link to irradiation technology Possible surface oxidation Products are likely to be batch processed during treatment, but could be made continuous with conveyor feed

Gas Plasma

Gas plasmas, simply termed plasmas are typically produced by applying energy (i.e., electric field) to excite or ionise gases such as inert gas, oxygen or moisturised air. They are a mixture of electrons, ions and neutral particles. Materials to be sterilized are passed through sterilisation chamber where ionised gases are contained. Generally, microorganisms when exposed to plasma undergo intense electron or ion bombardment. This results in cell death or injury (Laroussi 2005; Maeda *et al.,* 2003).

Previous work has showed that the surface of meat could be decontaminated using plasma technology. Gysin (1986) has claimed that the treatment reduced microbial loads on carcasses by up to 80%. In the study of Mackey and Mead (1990), it has been demonstrated that microbial growth was inhibited on treated beef samples, resulting in a 1 log difference at the end of their storage. Both studies have also reported that ionisation of the air in a chill chamber could reduce the microbial load of the air, and thus reduce further aerogenous contamination of the stored carcasses. However, these studies were difficult to repeat and the decontamination effects were difficult to prove.

Other applications of plasma have also been evaluated. Leipold *et al.* (2010) have investigated the decontamination of a rotating cutting knife used for slicing in the meat industry by plasma. A 5-log reduction of *L. innocua* was observed after exposure of the knife to plasma operation for 340 seconds. It was also reported that the temperature of the knife after treatment remained below 30°C. Rowan *et al.* (2007) has also developed a potential method for generating plasma in liquids as a way to treat waste water from food industries, such poultry wash water. Treatment of wash water with plasma for up to 24 seconds at 4°C resulted in non-detectable levels (up to 8-log reduction) of *E. coli*, salmonellae, *Campylobacter* spp. and *L. monocytogenes*.

References

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Maeda, Y., Igura, N., Shimoda, M, Hayakawa, I. (2003) Bactericidal effect of atmospheric gas plasma on *Escherichia coli* K12. International Journal of Food Science and Technology **38**: 889-892.