



AMPC/Sheep CRC/MLA Case Study

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Fact sheet – Types of Electrical Stimulation

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This is the second fact sheet in a series of three fact sheets about electrical stimulation.

Head stunning

Most sheep processors begin the slaughter chain with electrical head stunning applied to the head of the sheep while in a V-type restrainer. This satisfies Halal requirements. Typical settings for this are 0.5 amp or greater for lambs and 1.0 amp or greater for sheep, with 200 volts or more applied for 1-2 seconds. In the head, the current passes through the brain and the animal will recover, unless exsanguination occurs within the period of insensibility of 35-45 seconds.

Immobilisation

Following exsanguination, some processors may apply immobilisation to the animals for occupational health and safety reasons.

The application of high frequency currents (2000 Hz, 400 volts with a pulse width of 0.15ms) has been shown extremely affective at reducing animal movement immediately after exsanguination (Figure 1). This reduces the risk of knife injuries due to reflex movements. These systems have also shown to have to no detrimental effect on meat quality.



Figure 1. High frequency immobilisation used immediately post exsanguination and before the carcasses are placed on the chain.

Source: E.S. Toohey

Electronic bleeding

As part of the development of new electrical technology in Australia a commercial system to increase the collection of blood was produced.

The system of electrodes administers current through the front legs (Figure 2). In this case the electrical parameters are 15Hz, 550 peak volts, constant current of 800mA, pulse width 0.5 milliseconds applied for 20 seconds.

This application of electrical technology has both the potential to reduce abattoir waste, reduce water use and provide additional income for those abattoirs that process blood.

The amount of blood released two minutes post-slaughter was 50% greater when a thoracic stick was used in combination with a Halal slaughter. This was compared to only a Halal slaughter. Additionally, if the carcass was also stimulated with low voltage stimulation (10Hz) at the sticking point, there was a 62% increase.

This process can also improve meat quality and increase consumer acceptance by making meat lighter and redder in colour.



Figure 2. Suspended sheep carcass showing the Y-cut and the electrodes in contact with the front legs.

Source: E.S. Toohey.

High voltage stimulation

High voltage electrical stimulation (HVS) was originally used to accelerate rigor mortis before the meat was frozen in both sheep and cattle, but now it is more widely used to improve quality.

Traditionally, HVS systems applied a fixed voltage averaged across all carcasses being stimulated. Rubbing bars have been used to apply high voltage stimulation to carcasses (Figure 3) at the completion of the dressing procedure. However, this process poses concerns for work safety, gives an average electrocution effect and is expensive, although it can significantly reduce toughness in sheep meat.



Figure 3. High voltage electrical stimulation unit, bottom rail is active.

Source: E.S. Toohey.

Medium voltage stimulation

A new approach to stimulation has been developed in Australia whereby each carcass is stimulated individually using segmented electrodes. This method ensures that each segment only contacts one carcass at a time using a medium voltage (Figure 4 and 5).

These systems are designed to keep the current constant, but vary the voltage using controlled electronics in response to a test pulse and feedback from the system on the resistance of the carcass (according to Ohms law).

Ohms law: $Voltage = current \times resistance$

Typical settings for medium voltage stimulation systems are 2A, 15Hz and 1ms pulse widths, equivalent to a maximum peak voltage of 350V.

The power levels and shorter pulse widths used in the medium voltage units eliminate the need for isolation of the units, a requirement of high voltage systems. These levels comply with occupational health and safety regulations (*Australian Standard 60479-2002*) within the plant.

This stimulation can be applied either pre dressing or post dressing. Most units are installed post dressing, roughly 20 minutes post slaughter and prior to entry to the chillers. Stimulation at the end of the chain is applied through the rub onto the hind legs.



Figure 4. Post-dressing medium voltage electrical stimulation unit, bottom rail is active.

Source: K. L. Pearce.

Alternatively, stimulation can be applied at the start of the chain within 1 minute of exsanguination (Figure 5). The application of stimulation is through the rail to the hind leg hocks, commercially referred to as transverse leg stimulation.

The use of medium voltage electrical stimulation at the start of the chain also increases the amount of collectable blood at slaughter.



Figure 5. Pre dressing medium voltage electrical stimulation.

Source: D.L. Hopkins.

Summary

A number of electrical inputs are available to Australian sheep meat processors to improve meat quality and occupational health and safety (OH&S).

Optimising the rate of pH and temperature decline improves sheep meat eating quality.

Meat Standards Australia (MSA) requires meat processors to measure and control systems to achieve the pH-temperature window.

Medium voltage electrical stimulation units at the start or the end of the chain can improve tenderness and meat colour by increasing the rate of pH decline.

High-frequency immobilisation at the start of the chain reduces animal movement and improves OH&S.

Low or medium voltage electrical stimulation at the start of the chain can increase the amount of collectable blood and also reduces waste.

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