

Electrical stimulation for improved eating quality

Key points

- Electrical stimulation enhances meat quality by improving tenderness and meat colour and is helping Australian processors to consistently deliver quality sheep meat.
- A number of electrical inputs are available to improve meat quality.
- Medium voltage electrical stimulation units at the start and 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 occupational health and safety.
- Low or medium voltage electrical stimulation at the start of the chain can increase the amount of collectable blood and also reduces waste.

Introduction

Electrical stimulation enhances meat quality by improving tenderness and meat colour and is helping Australian processors to consistently deliver quality sheepmeat. Electrical stimulation can also improve occupational health and safety, increase blood collection and enable faster carcass throughput.

A variety of electrical inputs are now available for use by Australian processors. Recent work jointly funded by the Australian Sheep Industry Cooperative Research Centre (Sheep CRC) and Meat and Livestock Australia has been undertaken to ensure the units are optimised to abattoir requirements.

Why use Medium Voltage Stimulation?

A new approach to electrical stimulation has been developed based on medium voltage stimulation (MVS). These systems are favoured over the traditional high voltage systems because they:

- use less electricity and are cheaper to run,
- are safer for workers as they comply with Australian Occupational Health and Safety regulations,
- can be located at either the start or the end of the chain depending on the availability of space, and
- can deliver electricity to each carcass individually, dependant on the responsiveness of that carcass.



Above: Medium voltage post-dressing system (6-module unit).

How does MVS work?

The system is devised of segmented electrodes that ensure that only one carcass contacts the electrodes at any one time. The current remains constant and the voltage is varied (peak 300V) by controlled electronics, which determine the resistance of the carcass and alter the voltage accordingly through a feedback system.

What are the benefits of MVS?

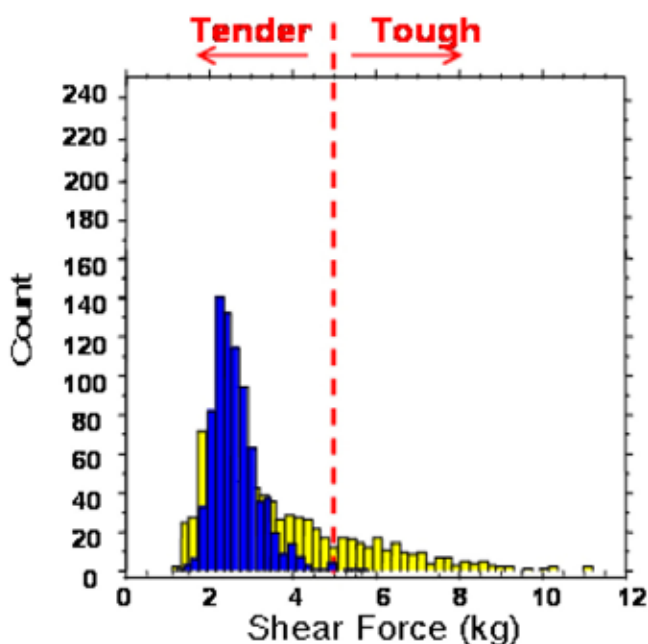
MVS has a number of benefits. These are improved sheep meat quality, improved occupational health and safety and increased efficiency.

How is sheepmeat quality improved?

Medium voltage systems are an effective way of controlling the rate of pH decline of carcasses post-slaughter. The rate of pH and temperature decline of a carcass can significantly affect meat eating quality. If the pH decline is too slow (high pH at low temperatures) cold shortening may occur. This is extremely detrimental to the quality of the meat and will result in tough meat and darker meat colour. Meat and Livestock Australia's Sheep Meat Eating Quality program identified that for optimal eating quality, meat intended for the domestic market (short-aged) should come from a carcass that has a pH of 6 between 18 and 35°C carcass temperature.

Table 1. The percentage of carcasses achieving pH targets of 6 under stimulation when compared to no stimulation.

	No stimulation	Electrically stimulated - optimal setting for domestic market (2.5ms, 1A, 15 Hz)
Carcasses at pH=6 between 18-35°C	14%	90%
pH >6 at 18°C	85%	10%



The extremely low compliance level for the rate of pH fall without the use of stimulation was widespread across the industry, thus the encouragement for processors to install MVS. Research aimed at optimising the MVS units to achieve a rate of pH decline that increases the number of carcasses that reach a pH 6 between 18 and 35°C has been undertaken.

Figure 1. A snap shot of lamb tenderness across Australia in 1998 (yellow bars) showed a large variation in shear force, a measure of tenderness. Subsequent sampling of lamb meat from stimulated carcasses that were aged for five days (blue bars) revealed the value of adopting technology to accelerate the rate of pH decline after death.

Improved occupational health and safety

The use of high-frequency immobilisation (see image below) at slaughter reduces animal movement and enables abattoir workers to begin processing the carcasses safely within approximately 30 seconds of death. These systems have also been shown to have no detrimental effect on meat quality.



Above left: High frequency immobilization (charge coming from back bar, with water used for better contact).



Above right: Low voltage pre-dressing system (current applied through rail to hocks).

Increased efficiency

If low or medium voltage electrical stimulation is used at the start of the chain (see image above), the amount of collectable blood can be increased. This reduces abattoir waste and water use and provides additional income for those abattoirs that process blood. The amount of blood release two minutes post-slaughter was 50% greater when a thoracic stick was used in combination with a Halal slaughter, compared to only a Halal slaughter. Additionally, if the carcase was stimulated with low voltage stimulation (10Hz) at the sticking point, there was a 62% increase. This can improve meat quality and consumer acceptance by making meat lighter and redder in colour.

Electrical stimulation also has other efficiency benefits. Abattoirs can run their chillers at lower temperatures reducing evaporation losses without compromising eating quality.

Take home messages

- A number of electrical inputs are available to Australian sheep meat processors to improve meat quality and occupational health and safety.
- Medium voltage electrical stimulation units at the start and 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

Further information

For further information visit www.sheepcrc.org.au

Acknowledgements

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