



AMPC/Sheep CRC/MLA Case Study

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Fact sheet – Optimising Electrical Stimulation

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

Background

The Sheep CRC and Meat and Livestock Australia (MLA) research has found that the rate of pH and temperature decline of a carcass can significantly affect sheepmeat eating quality.

The pH and temperature window

The ideal 'window' is a specification used to describe the relationship between pH and temperature fall during chilling and the objective is to manipulate pH fall so it passes through the window.

Hitting the window (Figure 1) can shorten the ageing time of meat to reach consumer acceptable tenderness, reduce the variation in tenderness and enhance meat colour. This benefits farmers, food processors and consumers by boosting the perception of lamb in the market place and increasing overall lamb consumption.

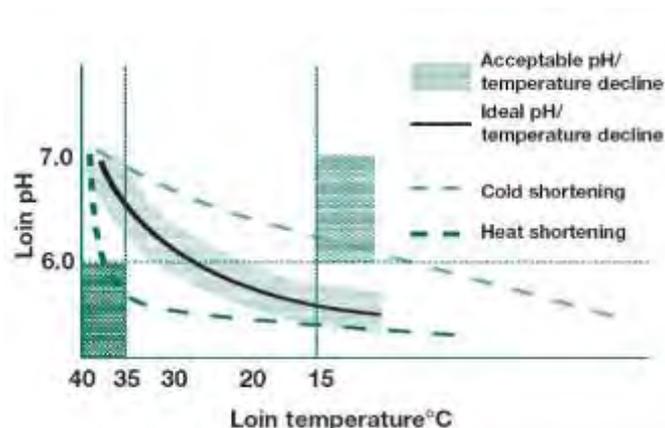


Figure 1. pH and temperature decline patterns that can result in heat and cold shortening (Courtesy of MSA).

Processors participating in the Meat Standards Australia (MSA) program for sheepmeat are required to measure and control systems to 'hit' the pH temperature window.

It is difficult to hit the window without methods to either slow temperature decline (compromising food safety) or speed up pH decline, achieved with electrical stimulation of the carcass.

Measures of pH-temperature decline

Rate of decline is commonly expressed in terms of the temperature at which the loin muscle of the carcass reaches pH 6.

To calculate the temperature at pH6, pH and temperature readings are taken at timed intervals using a combined pH/temperature meter during chilling. Using the standard location for measurement is very important.

This data is then used to calculate a rate of pH by temperature decline from which it is possible to predict the temperature at pH6.

Standard pH measurement location is found at the lumbar-sacral junction, overlaying fat is cut away so as to prevent fouling of the pH electrode (Figure 2).



Figure 2. Standard pH measurement location.



New pH Temperature guidelines for sheep

MSA lamb and sheepmeat research has identified optimal eating quality pH/temperature targets for specific markets the targets (Table 1).

Table 1: pH Temperature guidelines for sheepmeat

Ageing Period	Hanging system	Required Temp@pH6
Short: 5 days (domestic product)	Achilles hung	18-35°C
Short: 5 days (domestic product)	Tender stretch/ pelvic hung	8-35°C
Longer ageing period 10+ days	Achilles hung	8-35°C

Compliance rates

In practice there is considerable variation between carcasses and it is difficult to get all carcasses within the window under commercial conditions. Results from abattoirs at different locations around Australia show that the number of carcasses which can achieve a pH of 6.0 at 18-35°C, without electrical stimulation is about 15% nationally, varying from plant to plant.

With the use of an optimal electrical stimulation setting this can be increased to over 80% of carcasses depending on the chilling regime of the abattoir (Table 2). Reasons for non-compliance include animal variability, fast chilling rate, low muscle glycogen levels (due to pre-slaughter stress or nutrition) and variation in stimulation units between abattoirs.

Table 2: pH temperature compliance before and after electrical stimulation was optimised.

	% of carcasses		
	Compliance	Non-compliance	
	pH6 18-35°C	pH <6 at 35°C	pH>6 at 18°C
No stimulation	15	0	85
Optimal setting (domestic market)	80	2	18

Auditing electrical stimulation performance

Processors should independently audit their plants to determine compliance rates of carcasses ‘hitting’ the pH temperature window. If a low percentage of carcasses ‘hit’ the window, then a number of alterations can be made including the use of electrical stimulation, which accelerates the rate of pH decline, varying the stimulation time and setting or adjusting the chilling regime.

Determine if the unit is working

The process for determining compliance rate is:

1. Processors should randomly select four consignments per day that reflect the variation in carcasses being processed over the day.
2. Within each consignment 25 carcasses should be measured (i.e. 100 sheep per day).
3. The pH and temperature of each carcass should be recorded at 20-30 minutes post slaughter (on entry to the chiller) and then again when the carcass is roughly at 18°C. This data should then be used to calculate the temperature at pH6 using the following equation. The temperature should be between 18-35°C for the carcass to ‘hit’ the pH temperature window.



$$\text{Temp at pH6} = \text{TempA} - \frac{\text{pHA} - 6}{(\text{pHA} - \text{pHB})} (\text{TempA} - \text{TempB})$$

TempA and **pHA** represent the first temperature and pH measurement taken 20-30 minutes post slaughter (usually above pH6).

TempB and **pHB** represent the measurement taken when the carcass is at around 18°C (usually below pH6).

4. This process should be repeated every 3 months.

If the electrical stimulation unit is not ensuring that carcasses reach pH6 before 18°C, the electrical stimulation inputs can be modified to suit a particular plant processing regime.

Checks in-between quarterly compliance tests

1. Conduct visual checks daily to assess whether carcasses are being stimulated normally and that the unit is on and the modules, if present are all delivering a stimulation dose.
2. To test whether the stimulator is working on a more regular basis: five electrically stimulated carcasses from four consignments are measured on entry to the chiller. The pH of the carcass needs to be below 6.6. If not, do a pH reading at 18°C and determine temp at pH6 as directed above.

If you are still achieving poor electrical stimulation compliance consult a Sheep CRC researchers.

Summary

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

MSA for sheepmeat requires meat processors to measure and control systems to 'hit' the pH temperature window.

Processors should do a quarterly audit of their plant's electrical stimulation performance to ensure pH temperature compliance.

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