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Tenderising Beef Using an Electrical Stimulation Method

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The need to overcome the toughening effects of poor slaughter abattoir operations, has long been recognized. Recent research by the CSIRO Division of Food Research has found that electrical stimulation of beef carcasses has a marked affect on the pH of the muscle and subsequently post cooking tenderness.

Temperature versus Tenderness

Contraction of muscle fibres can take place over a period of 18-20 hours after the animal has been slaughtered provided rigor mortis has not previously "set in". During normal meatworks operations, muscles shorten following subjection to temperatures below 10°C. This is known as "cold shortening". Chillers are operated at temperatures below 9°C because of the relationship between the extent of muscle shortening and growth of microbiological organisms, muscles that have "set" prior to entering the chiller will not cold shorten regardless of temperature.

Alternative Methods Used for their Tenderising Effects

There are currently three basic techniques available to minimise post mortem shortening of the muscles. These are:-

- (i) suspending the carcass pre-rigor from the pelvis,
- (ii) conditioning the carcass pre-rigor at 10-20°C and
- (iii) electrical stimulation

Electrical stimulation has received increased interest from meatworks because:

- (a) it requires little change in normal abattoir practice and
- (b) the removal of the meat from the carcass pre-rigor (hotboning) can become a practical possibility.

Electrical Stimulation Method

Three possible alternative systems are currently available to meatworks throughout Australia. The first two are fully automatic, high voltage systems using about 1000 volts peak and requiring isolation in a protective enclosure. These methods require sufficient length of rail to ensure the carcass receives 90 seconds stimulation at some stage between bleeding and splitting. The alternative system uses an extra low voltage connected via a rectal probe post bleeding.

The extra low voltage (ELV) electrical system operates with 110 volts pulsed direct current, 40 pulses per second, 45 volts AC. The probe is inserted into the animal's rectum after bleeding and the animal is stimulated for a 90 second period during an increased voltage three stage cycle. The significance of ELV is that the animal is safe to touch whilst being stimulated.

Effect of Stimulation

In general, the greater the voltage applied, the greater enhancement of tenderness. Research carried out by the CSIRO using the ELV system, indicated that the hindquarter muscles are subject to a greater tenderising effect than the forequarter muscles. The pH values for hindquarter muscles are significantly less in treated than in untreated animals. Further trials have shown that electrical stimulation can produce tender beef comparable to that obtained following a 2-3 week ageing period in the chiller. However, stimulation of the carcass with additional ageing will improve the tenderness of the muscle to an even greater extent. Nevertheless, electrical stimulation or conditioning will not make stressed ante mortem muscles tender, but rather minimise the toughening effects caused by post mortem treatment.

Practical Application of Electrical Stimulation

Apart from the definite tenderising effect upon the edible product, deboning of carcasses or reduction of carcasses to small cuts within 2-4 hours of slaughter has become a distinct possibility using electrical conditioning. Such practices may have ramifications of reduction in required chiller space and decreased labour requirements within the abattoir.

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