

SNAPSHOT

OPTIMISING MEAT QUALITY AND FUNCTIONALITY THROUGH NOVEL PROCESSING INTERVENTIONS

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Project Description

Tenderness is recognised as the most important palatability trait for eating satisfaction of meat and, consequently, has a great impact on its value and repeat purchase by consumers. Colour is decisive in fresh meat at display but, once the meat is cooked, this becomes almost irrelevant. Compared to tenderness, flavour is of less importance provided that no off-flavours are present. In this context, meat processors demand interventions which improve the tenderness of low-value muscles and ensure the consistency of high-value muscles. The development of processing interventions for meat tenderisation is a keystone in boosting the profitability of the Australian meat industry.

Project Content

This project focused on the development and evaluation of novel processing technologies for rapid tenderisation and increasing value of beef cuts. We identified, evaluated and developed post-slaughter processing interventions for extending and enhancing the quality traits of fresh muscle and studied changes with ageing. The investigated technologies were pulsed electric field, ultrasound and shockwave processing.

Project Outcome

Pulsed electric field (PEF) processing

PEF is an emerging processing technology where meat is treated with short, high voltage pulses aimed at modifying muscle structure, and ultimately, achieve tenderisation¹⁻⁴. Our study found that PEF processing (0.25 kV/cm, 100 Hz, 10 μ s pulse width, for 30 ms) increased tenderness (after storage at 4 °C for 1 day) by 8.5% and 12 to 15 % for beef striploin and rump, respectively. There was no effect of PEF treatment on topside muscles. Other quality parameters (drip loss, cook loss and colour) were not affected by PEF treatment. Sensory evaluation indicated an improvement in juiciness for, but not tenderness of, PEF treated striploin.

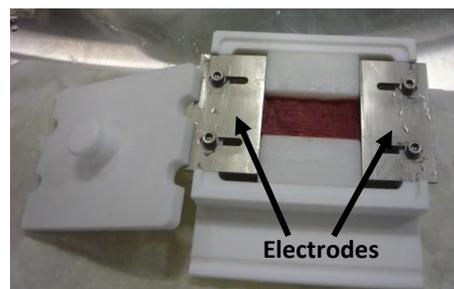


Figure 1. Modified PEF treatment chamber for treatment of solid foods.

Ultrasound processing

Ultrasound treatments have been reported to mechanically disrupt meat tissues due to cavitation⁵. However, in this study, ultrasound processing at 40 and 80 kHz up to 5 min did not significantly affect tenderness, colour or pH of raw (immediately after its application or during post-treatment ageing for up to 14 days) or cooked brisket. More intense ultrasound treatments resulted in significant surface discolouration due to overheating of the meat cuts.

Shockwave processing

Shockwave technology, or hydrodynamic pressure processing, is the application of mechanical pressure pulses that disrupt the muscle structure resulting in an instantaneous tenderisation and accelerated ageing of the meat⁶. Shockwave processing (at 35 kV, 1 pulse every 30 mm) of beef striploin muscle increased its tenderness by 12.4%, 8.2%, and 5.8% after ageing for 1, 11, and 21 days. Drip loss, cook loss and colour were not significantly affected by the shockwave. Because of the physical principle behind the shockwave effects and non-invasive nature of the technology, shockwave provides a unique opportunity to tenderise meat in a mechanical manner.



Figure 2. Shockwave treatment unit at CSIRO, Coopers Plains, QLD.

Benefit for Industry

PEF processing for meat tenderisation is potentially a commercially viable option for the Australian meat industry to improve tenderness of low-value cuts and/or accelerated aging. We estimate that the costs of processing would be approximately 7.3 cents per kg of meat. Labour costs for running PEF systems for meat tenderisation make up approximately 66% of the overall processing costs/m³ product. However, labour costs are highly dependent on the degree of automation for loading and unloading of product from the treatment chamber. Today, intelligent loading and unloading systems are offered by manufacturers which can significantly enhance the cost performance of PEF production lines (but requires initial high capital investment). Ultimately, continuous PEF treatment systems for solid foods using conveyor belts and flexible electrodes should be developed to increase throughput and minimise labour requirements.

Shockwave technology is a highly promising process for meat tenderisation, and investment could provide the industry with a new method for meat tenderisation and microbial decontamination. The world's second shockwave unit for meat processing, and the first for Australia, has recently been installed at CSIRO in Brisbane. This unit is available for the Australian meat industry to assess this technology. Shockwave has the potential to improve meat quality and increase the safe storage time of meat intended for export markets.

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