AMPC

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SNAPSHOT

Improving beef colour at grading

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Project Description
This project demonstrated the potential of mild heat treatment as a strategy to improve the colour of dark non-compliant post-rigor beef.

Project Content
Colour is the most important pre-purchase quality trait of meat, because consumers use colour as an indicator of quality and freshness at the point of sale. Australian processing plants assess colour at grading and it is one of the criteria that determines the value of the carcass. Beef carcasses are downgraded when the loin has a high ultimate pH (pH_u > 5.7), which often corresponds to dark non-compliant meat colour. The majority of research aiming at reducing the incidence of dark cutting has focused on practices that result in increasing muscle glycogen prior to slaughter. This project took a different approach and re-examined the role of muscle structure in determining meat colour, and further investigated whether some interventions could be used to manipulate muscle structure to improve meat colour. The project consisted of four main stages:

1) the development of a reflectance scanning laser electron microscopy (rCLSM) technique to study how changes in muscle microstructure impacts on light scattering,
2) an industry survey on the incidence of dark cutting and identification of potential interventions for its prevention,
3) a cost benefit analysis (CBA) of potential interventions, and
4) design and optimisation of a proof-of-concept process for improving the colour of dark cutting beef.

Project Outcome
A novel rCLSM technique was developed for the characterisation of the microstructure and the quantification of light reflectance (i.e. light scattering) in muscles. This method represents a new capability which can be used by the Australian Meat Industry in future projects to improve understanding of the relationship between muscle structure and meat quality, especially meat colour.

The industry survey of 15 processing plants highlighted that the incidence of dark cutting was 12.0 % compared to 5.3 % reported by Meat Standards Australia in 2017. However, there was wide variability between plants, ranging from 0.6% to 41.3%. The survey indicated that the financial loss from downgrading of dark carcasses ranged from 10 c/kg to 2 $/kg, depending on the category and the grade of the animal.

A CBA, in the form of an Excel spreadsheet, was developed as a decision making tool for the processors to estimate the costs and benefits of implementing an intervention to improve meat colour (a link is provided below in Useful Resources).

A mild heat-treatment (45 °C for 5 hours) process was designed and optimised to manipulate muscle structure of dark beef cube rolls. This heating process induced lightening of the muscle (see the images below) and increased both lightness (*L**) and redness (*a**) of the steaks compared to the control, untreated sample. This improvement in the visual appearance led to a higher consumer acceptability of the heat-treated steaks compared to the control at day 0 of retail display. However, the heat-treated steaks showed a lower colour stability during display, and thus, control samples had a higher acceptability than heated samples at day 5. Besides improving colour, heating of the cube rolls also enhanced the tenderness at day 0. However, there was no additional improvement in tenderness of the heated samples after 24 days of storage. There was an additional drip loss of 0.5 and 1.0 % in the heat-treated cube rolls during vacuum storage for 0 and 24 days, respectively. Microbial counts were not impacted by the heat treatment, hence with this intervention, meat colour can be improved without jeopardising microbial shelf life.

Pre-heat

Post-heat

Benefit for Industry

This mild heat-treatment intervention (45 °C for 5 h) can provide a competitive method for improving the colour of dark primals. It is possible to apply the heat-treatment for up to 96 hours post-mortem without compromising the benefits. This enables the collection and accumulation of dark primals during a working period, and then subjecting them to a batch heat treatment later on. The heat-treated primals need to be dispatched for retail sale within 1-3 days after treatment and sliced into steaks, to maximise the benefits from this intervention. The implementation of this intervention would only require a recirculating water bath with temperature control.

USEFUL RESOURCES

Cost benefit analysis tool and manual