Snapshot Report

AUSTRALIAN MEAT PROCESSOR CORPORATION

Meat quality in live animals

Non-invasive measurement of meat quality in live animals using deep tissue Raman spectroscopy

Project Code	Prepared by	Date Submitted
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Project Description

The objective of this collaborative project between staff at RMIT and NSW DPI was to reduce the level of dark cutting (DFD) meat in Australia by developing sensor technology that can be used to screen cattle in real-time at the abattoir, either at receival, or immediately pre-slaughter. This will allow dark cutting susceptible animals to be diverted so they can better recover their levels of glycogen. A fast, non-invasive, field portable Raman spectroscopic device capable of subsurface measurements, called Spatially Offset Raman Spectroscopy (SORS), was trialled to determine its potential for detecting DFD in beef samples, carcasses and cattle.

Project Content

A SORS spectrometer designed for use in warehouses by non-experts was purchased and adapted for working with beef samples. Initial studies were conducted to determine if SORS could detect important biomarkers known to be indicative of DFD and beef quality in general, before progressing to more industry-relevant conditions. Experiments were performed at an abattoir on carcasses to test compatibility of SORS with standard abattoir operations. Although Covid restrictions prevented studies on live cattle we were able to test the ability of SORS to measure the required data through the layers of hair, skin and extra muscular fat of a freshly deceased cow. In this way, we tested the feasibility of SORS to detect DFD under conditions increasing in complexity and industry relevance, from different cuts of beef to carcasses in abattoir and farm settings.

Project Outcome

We were successful in not only showing that SORS can detect DFD in cuts of beef but also in intact carcasses at an abattoir. Our SORS data were validated against standard industry tests for DFD (pH and glycogen content) and the known histories of carcasses. Furthermore, we found that SORS was sensitive to important biochemical determinants of beef quality (lactate, glycogen, cortisol, glucose) and able to characterise the pH and biochemical composition of different beef cuts (Scotch fillet, tenderloin, chuck, round, rump, and T-bone). We found that these measurements could also be performed through the hair, skin and fat layers of the loin and leg regions of cattle and carcasses, verifying potential for on-farm and at-abattoir use of the technology. We have also built the computational tools that would be the foundation for future use of SORS by non-experts needing a fast and reliable prediction of DFD status in an animal.

We conclude that SORS can detect DFD dark cutting in beef and carcasses and is sensitive to biomarkers important for determining beef quality.

Benefit for Industry

Development of this fast, deep tissue sensing technology will be a global first for the meat industry, providing Australian beef producers with a significant market advantage. By detecting and quantitatively determining key biochemical determinants of meat quality at the abattoir or farm, SORS can be used to assess the likelihood of dark cutting in carcasses and, potentially, live animals. This would assist on-site and real time decision making about lairage. In addition, the ability of SORS to directly measure other characteristics of beef quality raises the potential of SORS as a fast, non-invasive and chemical-free tool for meeting other challenges in the beef industry, such as for authentication, and for testing of nutritional and quality characteristics so guiding producer and consumer decisions.