

# Meat technology-What's new

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## Enhancing the colour of dark-cutting beef

Dark-cutting beef is normally caused by pre-slaughter stress leading to depleted muscle glycogen stores and reduced post-mortem lactic acid production, resulting in a high ultimate pH (>6.0). The high pH increases the light-absorption and water-binding abilities of post-mortem muscle, resulting in an undesirable dark and dry lean surface. High pH meat can also have a persistent red colour during cooking giving the appearance of being under-cooked. This is caused by the myoglobin being protected from thermal denaturation.

Scientists in the US injected lactic acid (LA) solutions into dark-cutting beef primals and assessed its effect on the pH, water-holding capacity, colour stability and cooked meat colour. Dark-cutting striploins with a mean pH of 6.56 were injected to 110% of their raw weight with lactic acid solutions of 0.25, 0.50, 0.75 and 1.00% concentration and compared with normal pH striploins.

Injection with 0.25% LA reduced the pH by an average 0.35 units whereas the higher concentrations of LA reduced pH by up to 2.14 pH units to values not normal for post-mortem beef. Normal pH steaks received the most desirable colour scores during retail display for 5 days, but the dark-cutting steaks enhanced with 0.25% lactic acid received scores approaching those of the normal pH meat. Steaks injected with 0.50 to 1.00% LA received poorer colour scores. The dark-cutting steaks (high pH) had the highest cooking yield, while those injected with 0.25% LA and the normal pH steaks had a higher yield than those injected with higher concentrations of LA.

When the steaks were cooked to an endpoint of 71°C, the dark-cutting samples received the lowest scores for cooked colour and degree of doneness, indicative of a pink 'medium rare' internal appearance. Steaks injected with 1.00% LA received the highest cooked colour and degree of doneness scores indicating 'well done' internal colour, whereas the scores for normal pH and those injected with 0.25% LA were similar, and intermediate. These results indicated that the appearance and cooked colour of dark-cutting beef could be brought closer to that of normal pH meat by injecting primal cuts with a 0.25% lactic acid solution.

## Blown pack spoilage of vacuum-packed chilled meat

Two psychrophilic organisms, *Clostridium estertheticum* and *C. gasigenes* have been recognised as the causative agents in blown-pack spoilage of vacuum-packed beef and lamb. Two similar, separate studies, one in Ireland and the other in the South Island of New Zealand, were undertaken to determine

the best method of detecting these organisms and possible sources of the cold-loving bacteria.

Two sheep-processing plants and their supplying farms were investigated in the NZ study and four beef plants from different geographic regions in the Irish study. Both studies used polymerase chain reaction (PCR) amplification of DNA to detect *C. estertheticum* and *C. gasigenes* in the samples collected.

In New Zealand, the organisms were commonly detected in the soil and water from the farms and in almost all the samples from the faeces and fleece of sheep. They were also commonly found in samples from the abattoir yards, but less often in the slaughter-floor samples and rarely in the chillers and boning room.

The organisms were commonly detected on the hides and faeces and in the lairage, bleeding and hide-removal areas of the Irish abattoirs. They were rarely found in the boning room or on carcasses.

Both studies indicate that the organisms enter the meat processing environment with the livestock and contaminate the carcass during the dressing process. The psychrophilic *Clostridium* had previously been associated only with Antarctic ecosystems, but the results of these studies indicate that they are also present in seasonally cold habitats.

## Improving the shelf life and palatability of lamb cuts

Many US consumers do not enjoy the flavour of lamb and prefer muscle protein from other sources. As a result of this and other factors, such as price and availability, annual lamb consumption has declined 64% since 1960 to 0.3 kg per person. In attempts to reverse this decline, the industry there is looking to develop new lamb products that better meet consumer tastes.

'Enhancement' by the injection of a solution of salts into primal cuts has been used to improve sensory characteristics of pork and beef. Lamb leg and loin cuts were injected with a solution containing salt (NaCl), sodium tripolyphosphate and rosemary then vacuum packaged and stored for 24 hours. Steaks or chops were then packaged in a modified atmosphere of 80% O<sub>2</sub> and 20% CO<sub>2</sub> and placed on simulated retail display with non-enhanced samples and assessed daily for 7 days.

Enhancement had little effect on fat or meat colour scores of an assessment panel over the display period, with little discolouration of all samples over the first four days of display. Lipid oxidation as measured by TBARS showed no differences between control and enhanced samples at the beginning of the display period, but by day 7, TBARS were higher for the control chops and steaks than for the enhanced samples. The values for the control samples were sufficiently high for there to be the potential for consumers to detect rancidity.

Taste panellists rated the enhanced loin chops and leg steaks higher for tenderness and juiciness, but were able to detect noticeable levels of salt and soapy off-flavours in the chops—due to the phosphate in the enhancement solution. Overall acceptability of the chops was not affected and the enhanced leg steaks were rated more acceptable than the control samples.

## Inorganic and organic pollutants in biosolids from meat processing plants

Biosolids are a by-product of the treatment of waste water from meat processing plants. The treatment process has the potential to concentrate heavy metals and organic compounds in the biosolids which are often spread on land as a fertiliser. Samples of biosolids were collected from the wastewater treatment plant of a Brazilian abattoir and examined in Germany for metals and the persistent organic compounds: PAHs, PCBs and PCDD/PCDFs.

Polycyclic aromatic hydrocarbons (PAHs) originate from fuels such as coal, oil, gas, wood, etc., and many isomers are known to be carcinogenic. PCBs (polychlorinated biphenyls) were synthesised for use as non-flammable insulators and were widely used in transformers. Production ceased worldwide in the 1970s, but they still remain in the environment. PCDD/PCDF (polychlorinated dibenzo-*p*-dioxins and dibenzofurans) describe a group of 210 individual structured compounds known as congeners. They are released into the atmosphere as by-products of domestic and industrial incineration and combustion processes when carbon, hydrogen, chlorine and oxygen are present together with copper as a catalyst.

Samples of biosolids were collected from various stages of the primary treatment of the abattoir wastewater and from the waste sludge from the activated sludge process. The results were compared with limits set by the United States EPA and the EU.

Trace metals were present in the biosolids, partly due to the addition of chemicals during the treatment process, but levels were below the limits established for application of sewage sludge as a fertiliser. The total concentration of PAHs in the biosolids was also below the limits for land disposal and incineration. Despite using very sensitive techniques, PCBs could not be detected in the samples.

PCDD/PCDFs could be detected in the ng/kg TEF (toxic equivalent factor) range for all the samples. The levels were below the World Health Organization and European Union limits for disposal to landfill. It was considered that the biosolids from this wastewater treatment plant would not represent a contamination risk when applied to agricultural soils.

## Antimicrobial resistance genes in bacteria from Australian cattle

There is the potential for antimicrobial-resistant bacteria or genes with antimicrobial resistance to enter the food chain due

to the use of antimicrobials in animal-production systems. If these genes are passed on to human pathogens, there could be an effect on the antimicrobial treatment of infections. Some bacteria contain class 1 and class 2 integrons which have the potential to harbour antimicrobial resistance genes. Cattle from three different production systems were sampled to determine the prevalence and diversity of integron-containing bacteria.

Faecal samples were collected from lot-fed, grass-fed and organically produced cattle from four Australian states. A total of 125 lot-fed, 125 grass-fed and 135 organically produced cattle samples were tested by polymerase chain reaction (PCR) for the presence of class 1 and class 2 integrons.

Bacterial isolates containing class 1 or class 2 integrons were recovered from 46% of lot-fed samples, 35% of grass-fed samples and 7% of organically produced samples. Most of the class 1 integrons were found in either *E. coli* or *Aeromonas* isolates. While the prevalence of integrons was higher in lot-fed than grass-fed cattle, the antimicrobial resistance genes harboured by the integrons differed very little. Also the antimicrobials for which the integron arrays confer resistance would rarely be used therapeutically or for growth-promotion purposes. Class 1 integrons from all production systems typically harboured genes encoding resistance to trimethoprim and streptomycin-spectinomycin.

Each of the five organic herds sampled had at least one sample positive for class 1 integrons. As antimicrobial use is not permitted in organic production systems, the presence of integrons presumably signifies the presence of a widespread natural reservoir of integrons independent of antimicrobial use; however, antimicrobials should be used prudently in production systems to avoid the development of integrons harbouring genes significant to human medicine.

## Food Processor Funding Opportunities

There are a few government funding opportunities currently available for food processors. Australia-wide, DAFF have a fund for developing and implementing innovative food processing ideas—round 2 applications have now closed, but round three is likely to open soon ([www.daff.gov.au/foodinnovation](http://www.daff.gov.au/foodinnovation)); and there is a fund available to help SMEs to access tailored advisory services in order to solve a particular problem in their business ([www.enterpriseconnect.gov.au](http://www.enterpriseconnect.gov.au)). In Queensland, the Queensland Government Smart Futures Fund has various programs aimed at encouraging innovation and improving skills (<http://www.industry.qld.gov.au/dsdweb/v4/apps/web/content.cfm?id=4979>).

*The information contained herein is an outline only and should not be relied upon in place of professional advice on any specific matter.*

## Contact us for additional information

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