WHAT'S NEW
Summaries of recent publications

Meat technology-What's new

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Low occurrence of enterohaemorrhagic *E. coli* in Australian cattle

The food poisoning organism, *Escherichia coli* O157:H7 has been declared an adulterant by the United States Department of Agriculture and meat products are widely tested for its presence. *E. coli* O157 is a member of the group of organisms known as enterohaemorrhagic *E. coli* (EHEC). Other *E. coli* serotypes in this group that also have the capacity to cause illness include: O26, O45, O91, O103, O111, O121 and O145.

While O157 remains the most commonly identified EHEC serotype, there is increasing attention being paid to the non-O157 EHECs; however, there has been little information available regarding the prevalence of these strains in cattle. They can be more difficult to identify and consensus is still being developed on methods to detect non-O157 EHEC. A CSIRO team collected faeces samples from grass-fed and grain-fed cattle slaughtered at 25 Australian abattoirs and tested them for the different EHEC serotypes using a real-time PCR-based approach.

The mean *E. coli* count was higher in samples from grain-fed cattle (6.42 $\log_{10}$ CFU/g) than from grass-fed samples (5.84 $\log_{10}$ CFU/g); however, there was no significant effect of feed type on the presence of the Shiga toxin genes which indicate the potential to be pathogenic. The Shiga toxin genes were present in 78 (26%) of the 300 faecal samples tested, with 30 subsequently testing positive for the presence of at least one EHEC serotype. Very few *E. coli* isolates contained the EHEC virulence markers. One O91, one O26 and five O157 isolates tested positive for the gene markers.

The study showed a very low (1.7%) incidence of *E. coli* O157 in Australian cattle and very few non-O157 *E. coli* serotypes with EHEC genes.

Influence of storage method of beef trim on shelf life of mince

Minced beef and hamburger patties are often produced by grinding beef trimmings from a variety of sources including frozen cartoned product, fresh from a carcase, and chilled meat that has been stored aerobically or in vacuum packs. European regulations require that meat for production of minced beef must be from carcases that have been stored for no more than 6 days, or from vacuum-packed beef that is no more that 15 days old. There is a lack of scientific evidence for this regulation and little knowledge of the effect of storage conditions prior to grinding on the keeping quality of beef mince, prompting an investigation by an Irish team.

Lean beef mince (approx 2.5% fat) was produced from cattle slaughtered in an experimental abattoir after chilling and boning, and handled in three ways: (i) trimmings were minced immediately; (ii) trimmings were stored aerobically at 0 and 5°C for 7 and 10 days prior to mincing, and (iii) trimmings were stored in vacuum packs at 0 and 5°C for 7, 10, 14 and 22 days before mincing. The mince was then stored on aluminium trays covered with an oxygen permeable PVC film and stored in the dark at 0 and 5°C for 7 days and subjected to microbiological, colour and odour analysis.

When trimmings were stored at 0°C there were no differences in total viable count (TVC) *Pseudomonas*, or lactic acid bacteria (LAB) from trimmings for any of the treatment time combinations. Trimmings stored aerobically at 5°C had higher counts for TVC and *Pseudomonas* after 10 days than that stored in vacuum packs. *Pseudomonas* is generally the dominant organism in mince stored aerobically, with high levels leading to spoilage. In these trials, the growth of *Pseudomonas* in mince was related to the previous trimmings storage conditions and the mince storage temperature. There was higher bacterial growth on mince stored at 5°C than when stored at 0°C. The bacterial counts in mince were initially lower than on the trimmings from which it was prepared. It was postulated that this was due to the bacteria being stressed by the presence of free oxygen radicals released by the mincing process. The alternative was that growth was slow due to transfer from the anaerobic conditions in the vacuum pack to aerobic conditions.

Pseudomonas grew well on most mince samples stored at 5°C except for the mince from trimmings that had been stored under vacuum for 22 days, suggesting that this length of time under vacuum inhibits *Pseudomonas* growth thus extending the shelf life of the mince. This mince also had higher redness values as measured instrumentally. Mince stored at 5°C discoloured more rapidly because of accelerated myoglobin oxidation. Off odours from the mince samples were detected when the *Pseudomonas* count reached 8.75 $\log_{10}$ CFU/g.

It was concluded that storage of trimmings in vacuum packs at 0°C before mincing resulted in a mince with better colour, odour and microbiological characteristics. *Pseudomonas* growth was suppressed when trimmings were stored in vacuum packs for longer than 3 weeks resulting in improved mince quality.

Algal biofuel from wastewater

Microalgae are often mentioned as an alternative energy source to fossil fuels. It is claimed that microalgae have higher biomass productivity than plant crops in terms of land area required; however, production costs are currently prohibitive and would need to fall significantly before algal biofuel would become competitive with oil. The use of wastewater to grow algae is one option to reduce production costs and has been the

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subject of scientific reviews. The wastewater provides most of the nutrients required and, in the process, the algae reduce the nitrogen and phosphorus levels in the wastewater.

When harvested, the algal biomass can be converted into a fuel source using several methods such as gasification, pyrolysis, hydrogenation and liquification to yield gas- or oil-based biofuels. It could also be anaerobically digested to produce methane or the lipids could be separated and converted to biodiesel.

High-rate algal ponds which use a paddlewheel to circulate the wastewater around a shallow pond offer a potential method of producing algae and also offer greater potential for algae harvesting and nutrient reduction than traditional ponds. The addition of CO_2 to high-rate ponds improves algae growth and this could be provided by flue gas from a fossil fuel burning plant; however, there are still many issues to be dealt with before the process becomes commercially viable.

One of the major issues to be resolved is the development of an efficient algae harvesting process. Algae are very difficult to remove due to their small size (<20µm), similar density to water and strong negative charge which prevents cell aggregation. Methods currently utilised include chemical flocculation, centrifugation, and filtration, all of which can be costly to operate. Enhancement of the natural aggregation to allow gravity settling would appear to be a promising option.

Other issues to be resolved include life-cycle analysis to determine whether the process is energy positive; and demonstration of the process at a commercial scale, as most of the research so far has been conducted on laboratory-scale equipment.

Radio frequency tempering of beef

The tempering of frozen meat prior to size reduction for manufacturing operations can be done slowly in air or rapidly using microwave or radio-frequency (RF) heating. RF heating involves the application of a high-voltage alternating electromagnetic field to a product placed between two electrodes. As there is little published information on the power consumption and efficiency of RF tempering of frozen meat, an Irish group has investigated these aspects using cartoned frozen beef of three fat contents.

Lean beef (95% visually lean) and beef fat were used to prepare three types of samples which were packed into cartons and frozen: a lean, a 50:50 blend and a fat sample. The cartons were tempered in a 50 ohm RF oven operating at 27.12 MHz and fitted with power metering equipment.

The 20 cm x 20 cm x 10 cm cartons of 50:50 mixture were tempered to -4°C in 10 minutes with a variation between the maximum and minimum temperature of about 2°C. There was less uniformity in the high-fat samples which tended to suffer from runaway heating, where the warmest areas attracted more and more of the available power. Conventional air tempering took over 5 hours. Leaner meat and higher power levels resulted in faster heating times and better power efficiencies; however, the peak efficiency only reached about 49%—which was less than the 60% generally recognised as being required for industrial RF technology to be sustainable.

No red meat link to prostate cancer

Prostate cancer is the second most common cancer amongst men and it has been hypothesised that a 'Western' lifestyle and dietary habits are contributing factors. To test whether meat consumption contributed to the incidence of prostate cancer, a review of 15 studies of red meat and 11 studies of processed meats, undertaken in the last 10 years, was done. This was in the form of a meta-analysis which combined the results of all the studies for statistical analysis.

No association could be found between high versus low consumption of red meat and total prostate cancer incidence; and also no association between red meat and advanced prostate cancer. There was a weak association between processed meat and prostate cancer that was not statistically significant. Overall the results of the meta-analysis did not support an independent positive association between red or processed meat intake and prostate cancer.

Robyn Warner joins CSIRO Food and Nutritional Sciences

We are pleased to welcome Robyn Warner to the team at CSIRO. Robyn is well known to the Australian meat industry. Before coming to CSIRO, she worked for DPI-V as a research scientist where she applied her meat-science and muscle-biochemistry training to problems confronting the meat industry. Dr Warner has a PhD in Food and Meat science from the USA, and an impressive publication record. The two awards of which she is proudest, have both been achieved for her role on the Meat Standards Australia food grading scheme. The latest award was as a winner of the Australian 2010 Eureka prize for a multidisciplinary team and the previous award was the International Meat Secretariat Millennium Prize in 2000. Robyn is based in Werribee, and is available for research projects and enquiries. Her contact details are listed below.

Contact us for additional information

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