MEAT & LIVESTOCK AUSTRALIA

fifth quarter

FEBRUARY 2006

Message from Stewart McGlashan, Program Manager

The 2005-06 co-products program is well underway with projects on the significance of *Salmonella* in meat meal, benchmarking of rendering costs and preparation of environmental best practice guidelines for rendering all commissioned. Looking forward, MLA will be building on previous feasibility studies to develop alternative uses for rendered products such as production of adhesives and biodegradable plastic from protein and production of hydroxyapatite from bone. I am also planning to look backwards to make sure that the outputs of the co-products program for the last six years have been implemented as far as possible.

This edition of *Fifth Quarter* features results of research that have been carried out over several years and are now ready for commercialisation. The electronic nose has been developed with the aim of improving odour management at rendering plants by real-time objective measurement of odours. The e-nose works by recognizing chemical signatures of compounds in air or head space. Although the e-nose is being developed with industry to recognise odours, it may also be able to measure characteristics of rendered products. For example a suitably designed e-nose may be able to measure rancidity or biogenic amines in meat meal and could be used to demonstrate that a meat meal is of Australian origin by detecting natural or added components. Any red meat processors interested in developing these potential applications of e-nose technology in partnership with MLA should contact me smcglashan@mla.com.au.

E-nose

Odour management is an inevitable part of operating a rendering plant. Renderers have developed a range of odour minimisation techniques and treatments to control odourous emissions. One of the difficulties in managing odour is getting objective measurements. If odours could be rapidly measured at different locations at a rendering site with portable equipment, renderers could monitor odours and quickly correct problems or detect trends. Renderers could also use odour measurements to monitor and assess the effect of changes in odour management techniques.

A promising method of rapid measurement of odours in meat works and rendering plants is by electronic nose (e-nose) technology. MLA has supported development of an e-nose over several years. An e-nose is an instrument with an array of sensors that can detect different chemicals in air. If the pattern of the relative amounts of chemicals detected by the e-nose can be correlated with the traditional methods of odour measurement such as dynamic olfactometry, the e-nose could be used to detect abnormal or unacceptable levels of odour in real time.

Figure 1: E-nose installed in an outside location at a meat works

MLA supported initial research in 1997 to characterise odours from rendering plants. In this work air samples were tested by dynamic olfactometry, which measures odour units in air, by GC_MS, which measures specific chemicals in the air samples and by e-nose. Following this work MLA commissioned the ChemoSensory Centre (csc) of the University of NSW to develop an e-nose which could be used for on-site surveillance of odours in the meat industry.

The CSC developed an e-nose with five chemical sensors, temperature and humidity sensors, an air sampling device, and an alarm system to report excessive odours. The electronic nose was then tested in a meat works for five months. The e-nose was tested in high odour environments inside the rendering plant and in low odour environments around the outside of the plant. The research team collected samples of air adjacent to the e-nose and tested the air for odour using dynamic olfactometry. The air samples registered 20 odour units or greater and the e-nose showed a strong response to all odours. The response patterns of the e-nose differed for the odours from difference locations and the instrument will have to be calibrated at each site to set alarm level for the particular conditions. The e-nose is clearly sensitive enough to operate in the 1 to 10 odour unit range.

MLA and E-nose Pty Ltd have obtained provisional patents relating to the development of the e-nose for meat industry applications. The next step is to further develop the instrument through industry/MLA partnership projects. The e-nose may have applications other than rapid detection of odours. For example it may be possible to adapt the e-nose to measure rancidity or biogenic amines in meat and bone meal. Also, it might be feasible to use the e-nose to detect natural or added components to prove that a meat meal is of Australian origin.

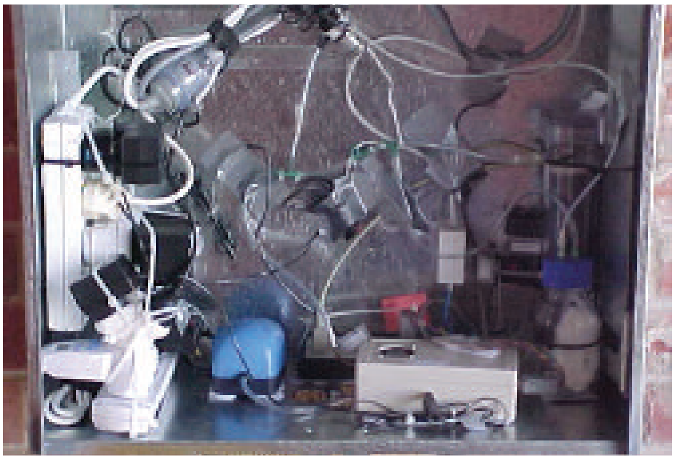

Figure 2: Inside the e-nose

Heat treatments in rendering

The Australian Standard for Hygienic Rendering of Animal Products does not specify any heat treatments to be used in rendering. Instead it requires that all rendering establishments validate their heat treatments on an annual basis. The validation is done by operating a heat treatment at the critical limits specified in a HACCP plan and demonstrating that the cooked product is free from *Clostridium perfringens*. This approach to validating rendering processes is based on requirements for approving rendering systems in the EU.

MLA has commissioned Food Science Australia to examine the requirements of the Australian Standard for Rendering to make sure that rendering systems validated according to the Standard can produce safe product. One approach to validation is to examine published data to determine what critical limits of a process have been found to be effective.

There are some published data about the effect of rendering conditions on reduction of biological hazards associated with rendering but the data is not sufficient to validate the wide range of rendering conditions used in Australia. The published data are difficult to apply to practical rendering conditions because only a limited number of heat treatments have been tested. In addition, the effect of rendering systems has been tested on a range of bacteria including *Clostridium perfringens, C. sporogenes, Bacillus cereus, B. stearothermophilus* and *B. anthracis*. These organisms are all relevant to Australian rendering conditions but with a relatively wide range of target organisms used in different experiments and a narrow range of rendering conditions tested, it is not possible to interpret how the results apply to all Australian rendering conditions.

However there are some clear messages from studies on the effect of rendering on the survival of heat resistant microbes. These are:

- processors should ensure that raw material is pre-broken to a consistent size, preferably less than 50mm, before rendering to ensure that there is adequate heat penetration through the particles

- high initial moisture levels in raw material helps in the reduction of bacterial spores in both naturally contaminated and inoculated material
- whether the heat treatment is applied in a wet or dry rendering system, it is the wet stage that has the most effect on reduction in the number of bacterial spores; the endpoint temperature when the moisture content may be low is less significant

In the absence of published information that can be used to validate the rendering conditions used in Australia, the Australian Standard for Hygienic Rendering of Animal Products requires that all renderers validate their heat treatment annually. This is done by testing cooked material for the presence of *C. perfringens. C. perfringens* is common in animal intestines and investigations have shown that it is present in raw materials for rendering at between 300 and 600,000 cells per gram. If cooked product is tested according to the Australian Standard method for enumeration of *C. perfringens* (AS 5013.16) the limit of sensitivity of the test is about 10 cells per gram. If *C. perfringens* is not detected using this test, it can be assumed that the rendering process has reduced *C. perfringens* by a factor of at least $10^{1.4}$ to $10^{4.7}$.

The Food Science Australia report suggests that AS 5013.16 could be performed by plating 3 x 3ml portions of a 1:10 dilution of the sample instead of plating a 1ml portion. This would increase the sensitivity of the test to about 1 cell per gram. If this modified test is used to show that *C. perfringens* is absent in 1 gram, it could be assumed that the rendering process has reduced *C. perfringens* by a factor of at least $10^{2.5}$ to $10^{5.7}$.

If necessary, it is possible to demonstrate a larger reduction on *C. perfringens* by inoculating raw material with high numbers of the bacteria or by using a more sensitive testing method. For example a most probable number method based on the superseded Australian Standard method AS 1766.2.8 could give a sensitivity of about 1 cell per 25 grams or even 1 cell per 100 gram depending on the sample size. A method with a sensitivity of 1 per 25 g would demonstrate a reduction by a factor of at least $10^{3.9}$ (7500 fold) to 10^{7} (10 million fold) based on initial contamination of 300 to 600,000 cells of *C. perfringens* per gram.

The Food Science Australia report to MLA recommends amendments to the Australian Standard for Hygienic Rendering that would more closely define how heat treatments should be validated. These recommendations, if implemented, will make validation more consistent across rendering plants and provide more reliable information about the effectiveness of rendering systems to eliminate microbial hazard.

A sub-committee of the Meat Standards Committee is currently reviewing the Australian Standard for Hygienic Rendering of Animal Products and will consider the recommendation in the MLA report.

Figure 3: All rendering processes in Australia must be tested annually to show that the heat treatment can eliminate C. perfringens

Co-product values

The value of co-products fell by $40 to $67 per head of cattle between July and October 2005 according to the MLA co-products price monitor. The value of co-products from Japanese steers was worst affected falling about $67 for a 330kg steer while co-products from a 178kg cow lost $40 per head. The loss of value was mostly due to a dramatic fall in the prices of offals exported to Japan, particularly tongues.

Japanese offals including tongues, rumen pillars, thick and thin skirt were at a peak in June 2005. The average FOB price of tongues in June was $45 per kg. Importers were stockpiling product against a possible triggering of import safeguards at the end of June. Importers built large inventories of high priced product while at the retail level demand was shrinking in reaction to high prices. Some restaurant chains removed tongue from menus. In addition frozen tongues from Australia and New Zealand have been partly replaced by boiled tongues from China. The fall in demand has made it difficult to clear the stockpiles of tongues and prices have fallen steadily since June 2005.

Other Japanese offals have also been weaker but the prices of these items have not fallen to the same extent as tongues and the reversals have been less dramatic. Prices of Japanese offal for the last 12 months are shown in Figure 4.

The Indonesian market for Halal lips, heart, lung and tongue roots has been firm and prices have been steady to firmer. Lung prices in particular have improved in price from $1.72 per kg in June to $1.87 per kg in October. Demand for livers in Russia has continued and prices have been relatively high although prices have slipped from an average of $1.96 per kg in June to $1.74 per kg in October. Restrictions on issuing import permits in Russia have affected liver prices.

Markets for tripe products are generally weak because of trade restrictions and registration problems in China and Malaysia. However, there were small increases in the average price of scalded tripe in September and October. The average price of scalded tripe in October was $1.15 per kg.

There has been demand for cheek meat, thick and thin skirts and tails from Korea. This demand has not been enough to prevent lower prices for thick and thin skirts but the average price of cheek meat has increased from $3.11 in June to $3.27 per kg in October and tails have increased from $4.3 to $4.7 per kg.

Rendered products have been under pressure from low prices for competing commodities such as soy meal and palm stearine. Despite low soy prices, meat meal increased from $350 per tonne ex works in June to about $425 per tonne in September. The increase was due to low production around Australia and reasonable domestic demand. However prices fell back to about $400 per tonne in October and will have to stay around this level if meat meal is to maintain a position in stock feeds in competition with soy. Tallow prices are relatively low but are still considered high compared with palm stearine. Export markets have been quiet and there has not been much movement in prices in the last three months. Prices of rendered co-products are shown in Figure 5.

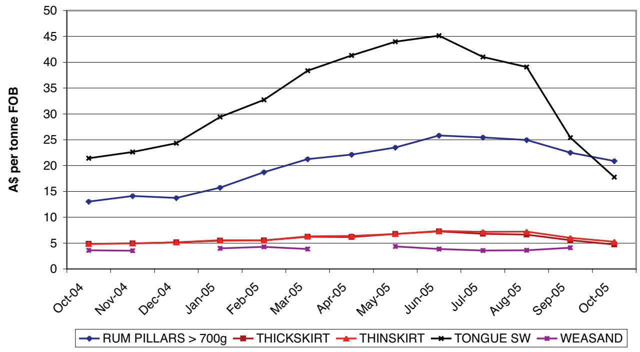

Figure 4: Average price of offal exported to Japanese markets

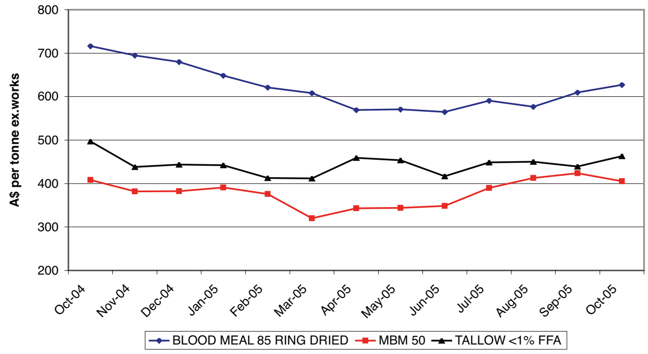

Figure 5: Average price of rendered co-products

Contact

Client and Innovation Services
Meat & Livestock Australia
Ph: 02 9463 9166
Fax: 02 9463 9182
Email: jsparks@mla.com.au

MEAT & LIVESTOCK AUSTRALIA

Level 1, 165 Walker Street,
North Sydney NSW 2060
Ph: 02 9463 9333
Fax: 02 9463 9393
www.mla.com.au