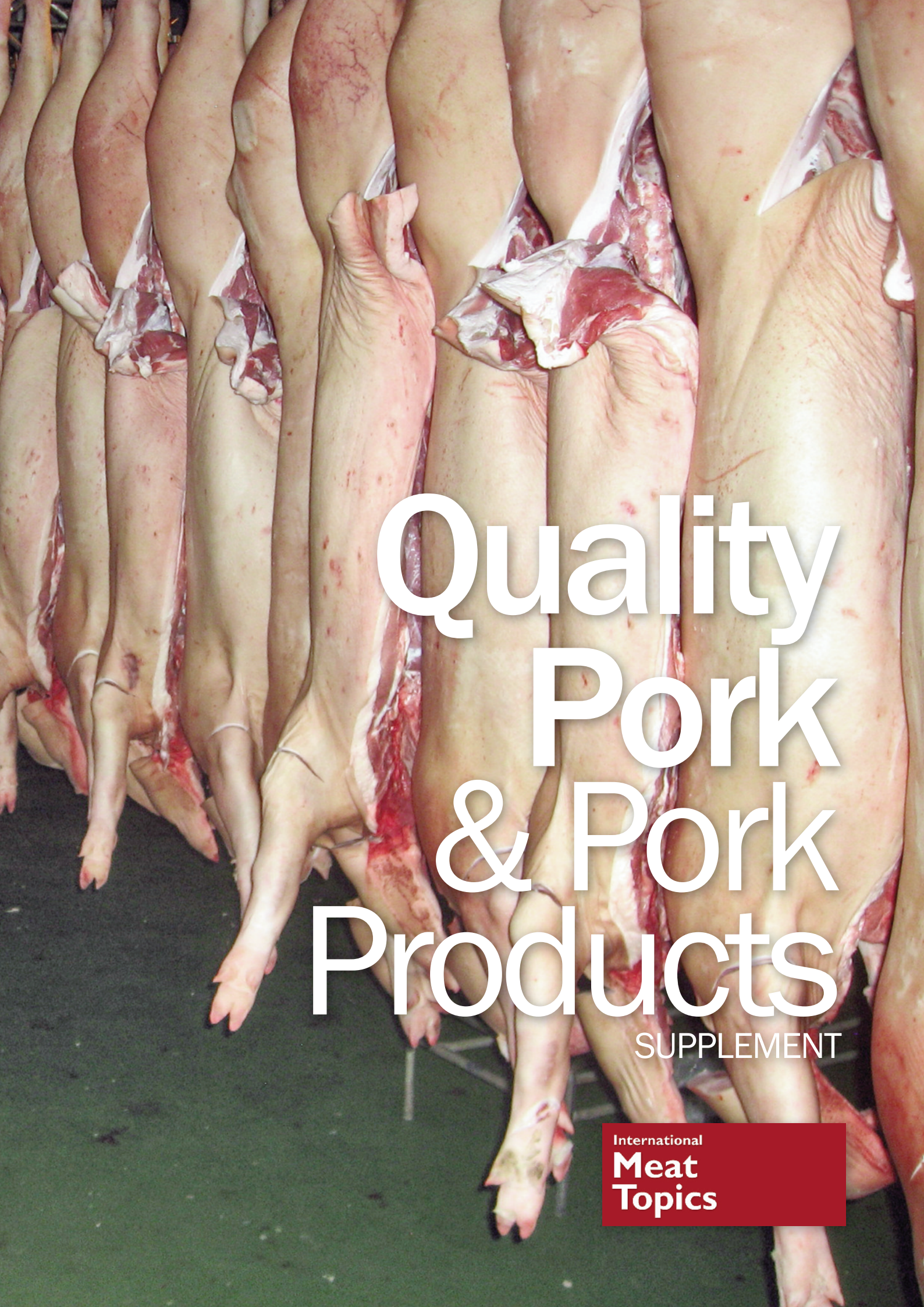

Quality Pork & Pork Products

SUPPLEMENT

International Meat Topics

Traceability system protects your reputation

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Traceability of components and products has been a critical issue in the international food industry for over two decades. As a result, dealing with this is part of the daily business routine for meat processors. The investment in money and time is well spent, considering what is at stake. Full transparency in production and a commitment to food safety delivers both consumer protection and, just as important, trust.

With the arrival of new technologies, the role of the consumer is changing. Using a smartphone or PC, consumers can easily retrieve product information and thus actively participate in the traceability of products. Manufacturers and retailers must therefore provide transparent, up-to-date information on all channels at the same time. Clear documentation of retail and processing routes of raw materials and products is not only required by law, but also an investment in credibility and image. It is also about business security and minimisation of risks. The constantly growing global trade of meat calls for efficient safety systems. In the case of an emergency, appropriate recall management based on a well-functioning batch information system can avert major financial damage.

An integrated traceability system links all parts of the operation including goods receiving, labelling and picking.

Legal requirements

Today there are numerous regulations on food hygiene, food information and traceability. The recent EC Food Information Regulation, for example, which came into force in December 2014 details the future indication of mandatory information that will be required including ingredients, allergens, place of origin, company address and nutrition declaration.

Companies that have firmly and consistently supported their operations with efficient IT solutions will clearly benefit when it comes to implementing these requirements. Qualified instruments for seamless traceability and proof of origin of raw materials and products comprise standardised and fully integrated organisational procedures, such as marking, scanning, identifying, weighing, labelling, measuring, controlling, reading and weigh labelling, as well as automated data capture at the CPs (control points) and CCPs (critical control points) throughout the entire production flow. These enable systematic quality management, HACCP (Hazard Analysis and Critical Control Points) and effective operational self-inspection.

Identification and labelling

At the same time, the implications of a product recall mean full transparency is required not just in manufacturing but in the flow of goods throughout the entire supply chain. Every business that wants to guarantee maximum accessibility of its products in the event of recalls needs proactive processes. However, it is only possible to monitor the whereabouts and history of the units if the physical flow of goods has been linked with the related flow of information.

For this reason, every unit, be it batches, packages, logistical containers or final products, must be labelled. This labelling must be kept throughout all stages of manufacturing, transport and sales to allow for systematic recalls in the case of incidents. Such labelling must comply with international communication standards.

Costs and benefits

As with any business decision, establishing the best traceability system starts with the analysis of economic benefits and the costs incurred. Implementing it requires the definition of binding rules, because every traceability solution must suit individual operational needs and thus be custom-made. Analysing all flows of goods and processes as well as the areas to be integrated is essential.

The following factors need to be taken into account when establishing the required transparency for full traceability: goods must be clearly identified, and the associated data linked with each other and stored in an archive. Key transaction data and master data have to be collected from pre-suppliers as well as internally, and communicated from one business partner to the next.

Finally, the data collection should be passed on to end consumers or database systems (for example, fTRACE and mynetfair).

As a prerequisite for establishing a functioning traceability system, units such as final products, batches, packages and logistical containers must be identified; and such IDs maintained at all stages of production, transport and sales.

Traceability along the logistics chain

A typical traceability system will start with goods receiving, where a lot number is first assigned. Products are then either booked in the inventory or immediately into production for further processing. In the case of intermediate storage, references to the lot number or batch number in goods receiving enable traceability of the products. This way, a direct link is established between the products and their origin and quality data. At every internal inventory movement, the system updates the respective ID details to allow for tracing of the different check points. Information carriers can be barcodes, 2D codes and RFID tags, and even image codes or colour codes.

Throughout production, the system needs to provide identification data for traceability of all items. Whenever a component is called in batch production, this identification procedure documents the lot/batch number in the production process, meaning the bills of materials (recipes) in production show the flow of goods back to the vendor. The finished products are then assigned a new lot number which is linked to the components that were used in the production process, and the links reflected in the barcode.

After production, the items must be automatically entered into the finished goods inventory, including all identification data for traceability. In shipping, the system will display the ordered items and the related finished goods on screen, so the items to be delivered can be automatically allocated to the respective customers.

The lot number is usually processed by scanning the barcodes of the delivery items. All goods movements along the logistics chain are captured at batch level and posted exactly to the cost centre of the functional areas.

The IT system captures the material and information flows for all products, detailing on which day and in which batch the product has passed which machine or department.

During the labelling and weigh labelling processes, the lot number is automatically transferred to the labelling systems and printed on labels. Shipping then allocates the lot or batch numbers to the customers by scanning the barcodes with the identification details of the products. Integrated weigh labelling systems enable full traceability but also sustained efficiency gains and considerable cost reductions.

Traceability pays off

Food production and trade are no longer a national concern, but a complex transnational economic fabric. Demands for food safety keep growing. An effective traceability system will not only ensure product safety but also protect company and brand image and integrity. ■

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Quality in boiled sausage production

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Worldwide, boiled sausage is among the most popular sausage categories. Famous examples are Hotdogs, Wieners, or Bologna. The first production step is grinding the meat.

Next, the ground meat is mixed with water/ice, spices and additives before being cut again, this time to finest particles.

The resulting emulsion is filled into casings and then boiled to 170°F (approximately 75°C) or higher. During boiling, the protein particles coagulate, enclose the remaining bits and solidify. This way, boiled sausage becomes irreversibly stabilised and, thus, sliceable in a warm or cold state.

Traditionally, the second step, the chopping of ground meat to finest particles and blending it with other additives, is completed in a bowl cutter. Using a high-performance cutter and the right ingredients ensures that the final product tastes intensely, has a fresh appearance, a tight structure and a long shelf life.

Furthermore, the use of premium quality machines optimises production efficiency: features like the vacuum-function ensure that the fast knives seize considerably more cell particles in less time. This increases the overall yield by saving material and time costs.

If flexibility concerning product diversity, which only a bowl cutter can provide, is not a requirement, an alternative method may be beneficial to the operators. Factories with a focus on a few final products and similar recipes can use a mixer and Konti-Kutter (emulsifier) instead of a bowl cutter. Then, the ground meat is mixed with other ingredients in a mixer before the Konti-Kutter emulsifies the mix. Since the Konti-Kutter operates continually, this way, batch-based interruptions are omitted and the production is completed faster.

Grinding the meat

For the first production step, the grinder should process the meat reliably and gently. Apart from keeping the temperature increase as low as possible, a clear cut – the most important trait of high quality meat grinding – is a must. However, the grinder also has to be strong enough to process resilient materials like frozen meat blocks.

The requirements on a grinder for gaining best results differ depending on the consistency of the source material. Fresh fist-sized meat pieces require less strength and transporting them to the working worm is easier, compared to frozen meat blocks. Those are 23.5 x 16 x 8" (600 x 400 x 200mm) large and fed into the grinder at -13°F (-25°C). Previously, two different machines processed fresh meat and frozen meat blocks. A recent innovation helps users grind more efficiently. Seydelmann's Universal Grinders process simultaneously or separately fresh or cooked meat, frozen meat blocks, fat blocks, rinds and other materials, independently of consistency and temperature.

Now, only one machine instead of two does the work. The purchasing costs are, therefore, significantly lower. However, Universal Grinders offer various further advantages related to efficiency and product quality.

Since simultaneous grinding of various materials is possible, the same working worm and cutting set can process both fresh meat and frozen blocks. Performing with one working worm and cutting set saves additional time and personnel costs. This versatility also grants an unachieved independence from the fluctuating prices of fresh and frozen meat. Now, a decision whether to use fresh or frozen meat is possible on a very short term.

The four speeds of the feeding worm and the six speeds of the working worm are pre-set steplessly and independently of each other. The operator can determine the ideal speed for the transport of any material from the feeding worm to the working worm. Thus, a gentle and yet efficient processing is possible for any consistency.

After grinding

Having been ground, the meat is mixed, chopped and emulsified with fat, water and other additives. Either a vacuum-cutter carries out these working steps or a vacuum-mixer homogeneously mixes the material before a Konti-Kutter, a continuous emulsifier with a unique hole- and cutting-plate system, chops and emulsifies the mixture.

Vacuum-cutter

The bowl cutter should be equipped with a vacuum-function and high cutting speeds. The faster the knives cut, the finer the emulsion and the higher the yield become. The vacuum-function further enhances the cutting quality and offers additional advantages. The amount of proteins extracted from the meat depends on the cutting speed. The faster the knives cut the more meat cells they seize and the more proteins are released.

The proteins bind the emulsion and more water can be added if the protein extraction is higher. Cutting individual meat cells frequently, furthermore, releases natural taste carriers, which optimise the meat aroma. In order to be able to produce sausages with varying grain sizes swiftly and reliably, the knife speeds should be continuously adjustable.

Furthermore, the number and shape of knives determine the cutting quality and grain size. The backwards gears allow spreading the inclusions within the emulsion homogeneously and without additional chopping.

Finally, the special geometry of the Seydelmann cutter bowl offers a very high filling degree and a minimum distance between bowl and knives. This design further improves the quality of both the cutting and the mixing and the vacuum-function optimises cutting quality. Under vacuum, the density of the processed material increases and the knives repeatedly seize even the smallest cell compounds.

The emulsion becomes even finer, more homogeneous and foam-free while, at the same time, even more proteins and flavour essences are released. The binding and stability of the emulsion increase; the final product tastes more intensely and has a firmer bite. Higher adding of water or ice is possible and less additives for taste intensification and conservation are needed.

Another elementary result of cutting under vacuum is the exclusion of bacteria from the emulsion, resulting in a considerably extended shelf life. Emulsions produced under vacuum lose 5-7% of their original volume while maintaining the original weight. Consequently, the costs for casings and packaging decrease.

Vacuum-mixer

Companies with a focus on a few final products with similar recipes can benefit from executing the second working step in a mixer and a Konti-Kutter. If flexibility with regards to product diversity, which only a bowl cutter can provide, is not a requirement, deploying a mixer and Konti-Kutter can accelerate the production. This method omits batch-based interruptions because the Konti-Kutter chops and emulsifies the material in a continuous mode.

After grinding, the meat is mixed with fat, water, additives and spices in the mixer before chopping and emulsifying the mix in the Konti-Kutter. Except for cutting, a vacuum-mixer offers the same vacuum-induced quality traits as a vacuum-cutter, including a reduction of air pockets in the material, a denser emulsion, a more stable colouring as well as a reduced fat oxidation and prolonged shelf life. When mixing under vacuum the meat cells open up further and absorb spices and additives better.

The innovative cutting technique of the Konti-Kutters is unique worldwide. A specially developed system of vertically ordered hole- and cutting-plates aspirates the pre-mixed material and thereby cuts it repeatedly. The plates are positioned at minimal distance from each other yet have no actual contact. Metal friction is avoided and a product contamination with metal particles can be ruled out. In the Konti-Kutter the degree of fineness can be determined flexibly. The flexible number of plates and the number of holes on each plate determine how finely the emulsion is cut.

Controlling the machines

The innovative 'Auto-Command' recipe control allows the operator to select all functions of a vacuum-cutter or a vacuum-mixer automatically and in this way achieves the optimum standardisation of batches.

The less complex working processes in a grinder and a Konti-Kutter are directed via the control 'Command'. Furthermore, all described machines can be connected into production lines via suitable transportation and conveying systems. In a production line the material is handed over from one station to another in a fully or partially automated manner – as desired by the user.

For best possible interaction between individual machines and an optimum standardisation, a central control terminal is available, which controls all machines from one central working place. Apart from product quality and production hygiene, an efficient production is an ever more important quality trait when evaluating the performance of machines in the food industry.

Among the most significant aspects are the processing speed, the ability to keep work force requirements and energy consumption low, the execution of several working steps simultaneously, and room efficiency.

The operating comfort and ease of use are further remarkable quality traits – apart from reducing the physical strain on staff, an easy usage is associated with a swifter production. Seydelmann machines help users save time, personnel, and energy, while at the same time making the best of any material and improving the quality of the produced goods. ■

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Meat species identification to prevent food fraud

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For many, food species identification may appear to be a fairly recent problem, but for a significant proportion of the world population this has been very important for thousands of years. For example, both Islam and Judaism have dietary guidelines that do not permit pork to be consumed alone or in any foods.

In much more recent times, the horse meat scandal in 2013 highlighted how relatively easy it is for certain food suppliers to abuse systems and supply chains by substituting lesser quality and value products for more expensive products, increasing their profit margins in the process. This food scandal sparked a huge enquiry and a massive increase in the volume of meat species identification testing.

As a result, even fish and fish products have come under close scrutiny. Filleted fish are often impossible to identify visually without their tell-tale skins, fins and other identifying characteristics.

The international organisation, Oceana, published a report in 2013 as a result of a two year investigation into seafood fraud in the US. Over a third of the seafood samples they analysed were mislabelled. Snapper and Tuna were most frequently mislabelled of all the species tested. Sushi restaurants had the worst record for mislabelled fish at 74%.

Even two years after this scandal first broke, the Food Standards Agency (FSA) is still reporting incidences of meat adulteration on a regular basis.

The scale of the problem

In 2014, local authority testing uncovered 44 separate incidents of meat adulteration in the UK. They carried out 426 tests for meat identification on 665 samples of pre-packaged foods. The products that returned 'unsatisfactory' results included minced steak and lamb burgers which contained undeclared pork, sliced lamb and black pudding containing undeclared beef, and goat meat products that were actually lamb.

It is not just pre-packaged foods that are at risk, but takeaway meals as well. Which? tests in 2014 revealed that 40% of lamb takeaways contained meats other than those declared, and some contained no meat at all! As a result the FSA announced a series of new tests. A larger survey conducted by the FSA of 307 curries and kebabs showed that 1 in 5 were contaminated with undeclared meats, showing that little progress has been made to stamp out this type of food fraud.

This problem got a lot more serious in the UK when it was discovered that some halal meals were adulterated with pork in various government run institutions in the UK last year. The BBC reported that traces of pork DNA had been found in halal prison meat contained in pies and pasties. As soon as the issue was highlighted a thorough investigation was initiated to rectify the problem.

Regulation

In light of these issues, the European Commission website gives more details on a number of the actions they have taken. Included in this are reviews to the Official Controls Regulation (Regulation 882/2004). These reviews include:

- Financial penalties for violations of the food chain law.
- The imposition of coordinated testing programmes, especially if food fraud is suspected.
- Ensuring that member states perform regular mandatory unannounced official controls including inspections and testing.

Available technologies

To help stamp out this type of food fraud, it is essential to have fast and reliable methods of testing. For animal species identification, different immunological methods exist for testing both raw and cooked meats suiting different laboratory types, sample numbers and required testing specifications.

It is possible to use ELISA or lateral flow to detect specific proteins in meat products as these types of systems show an analytical sensitivity of approximately 1%. However, processed food is problematic as the proteins are denatured by the heat and chemical elements within that process.

Mass spectrometry is a highly complex analytical system that detects the fingerprints of specific cleaved peptide fragments. This is a much more sensitive method but only a few highly specialised laboratories are able to do this.

DNA is considered to be the most accurate analytical target and provides a reproducible means of differentiating one species from another. It generally remains unaltered in cooked and processed foods. This precise method of testing is required because, aside from the offence and upset caused to some sections of society, this is also fraud. The repercussions of this fraud grows with each person or company that purchases the mislabelled meat as it makes its way through the supply chain.

Qualitative real-time PCR

Qualitative real-time PCR is the method of choice for meat species detection. Real-time PCR is an established technology in food analysis, widely used for GMO, allergen, pathogen and clinical analysis. Qualitative real-time PCR enables a highly sensitive and specific identification of the animal species in the presence of meat from other species. The nucleus and the mitochondria in each cell contain the entire genetic code and out of this blueprint specific information can be amplified.

The released fluorescent dye of the probe will enhance an exponentially growing optical signal. In a real-time thermocycler device this process is performed automatically in closed tubes or plates and after an hour, or 35-45 cycles, the analyst may detect the signal indicating that the specific DNA was present in the sample.

Technology is continuing to advance, providing increasingly more accurate results in shorter amounts of time, while testing programmes are becoming more rigorous. It is hoped that the result will be that this type of fraud along with the associated economic loss and distress to large sections of the community can be prevented. ■

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Salmonella and listeria: control challenges

When it comes to the production of quality pork and pork products, product safety is a key component of our definition of product quality. It could well be that in some countries pork could assume a more important role in food poisoning because of a recent trend to undercook some products. Historically, pork benefitted from overcooking as a result of being perceived as 'a dirty meat'.

Two common bacteria that cause food poisoning are Salmonella Spp., typically Salmonella typhimurium, and Listeria monocytogenes. These two bacteria behave in very different ways and in this article we will explore this further.

In 2003, the then Defra conducted a survey of animals at slaughter in Great Britain to determine the faecal carriage of pathogens, including salmonella in pigs. This study was similar in design to a previous abattoir survey conducted in 1999-2000. In the 1999-2000 survey salmonella was isolated from 23% of caecal samples taken from slaughter pigs and from 5.3% of carcases. No improvement in levels of salmonella was found during the second survey in 2003, with 23.4% of caecal samples testing positive. Surveys elsewhere in the world have had up to 48% of samples positive.

A French study undertaken in 2010 looked at end products. A total of 320 samples (minced pork meat, pork chop, fillet and roast, and other various pieces) were collected and 12.8% of the samples yielded Listeria monocytogenes; minced pork meats were particularly contaminated (25%). L. monocytogenes has been particularly associated with pâtés in the past. This is of particular concern since these products are usually not cooked before consumption.

Salmonella and listeria differ in one very basic way – salmonella tends to have a farm origin, that is they come into the slaughterhouse with the pigs. L. monocytogenes, on the other hand, tends to be processing/production plant sourced and particular plants often have their own residential strain of L. monocytogenes. Reducing the former will be best achieved by actions on the farm, whereas for the latter actions to reduce contamination are best focused on the plant.

FIve key messages

When it comes to salmonella control the British FSA champions five key messages to underpin their back to basics campaign. Practising these can help control salmonella and help improve herd health generally; positively effecting general performance and productivity on the unit.

These key messages are:

- **Salmonella control starts with weaners.**
  - Source and maintain salmonella free breeding stock.
  - Know the salmonella status of your weaners and manage pigs to control cross contamination.
- **Rodents, wild birds and cats carry salmonella.**
  - Make sure pigs, buildings, feed and feed stores are protected, vermin controlled and wild birds and cats are excluded.
- **Farm hygiene and biosecurity can prevent salmonella infection.**
  - Keep buildings, overalls, boots and farm equipment clean and disinfected and control visitors and vermin.
- **All-in, all-out production can control cross-contamination between batches.**
  - Clean and disinfect effectively between batches.
  - Have a one way pig flow.
  - Aim for small group sizes with minimal mixing.
  - Manage sick pens and do not mix sick pigs back into main production.
- **Pig health, feed and water can help control salmonella infection.**
  - Management for a healthy herd will reduce stress and help control salmonella.
  - Meal or liquid feeding may help control salmonella.
  - Acidification of feed or water can promote gut health and minimise salmonella and other infections.

Focus on hygiene

When it comes to L. monocytogenes control we should focus much more on the hygiene in actual processing and further processing plant environments. Firstly, this starts with design and construction which should be such that the place is easy to clean and sanitise and then we need to focus on the actual quality of the cleaning and sanitising process.

Two areas deserve particular attention because they provide damp/wet conditions which favour L. monocytogenes. The first of these is conveyors whose design often favours the retention of water and debris between the actual conveyor and the flat surfaces opposing it on the infrastructure underneath the conveyor. This is best achieved by slackening off the conveyor to facilitate cleaning under it and then keeping the conveyor raised from the infrastructure to hasten drying.

The second of these is the type of air cooler which passes air over wetted vanes to cool it. If the vanes become contaminated with L. monocytogenes the cool air being produced can also become contaminated. Another source of contamination from this type of cooler is drips of contaminated water from a damaged drip tray or from a full one that is overflowing.

The best way to manage wet vane coolers is not to have them in the first place, but if you do have them they need to be regularly subjected to bacteriological testing, servicing and deep cleaning and sanitising.

So, in the case of L. monocytogenes QC checks in production areas should not just be for the actual bacterium, but for damp/wet and dirty areas that have the potential to harbour this pathogen. A key part of its control is to make the production area environment such that it does not favour the survival of L. monocytogenes. ■

This supplement was produced by

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