Cutting-edge analytical technologies and best practices

Meat and meat-based products provide a rich source of protein, essential minerals and vitamins for billions of people around the world. To ensure these food items adhere to safety regulations and meet consumers' expectations for quality, it is vital that processors leverage robust tools for analysis and testing across the meat value chain.

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Meat processing is a multifaceted operation. Meats are very complex raw materials where small changes in compositional parameters, such as fats and protein, can lead to large variations in final meat quality and safety standards are critical. As global food regulations and profit margins tighten, the meat industry finds itself facing new challenges to meet market, consumer, and safety demands.

To piece together this puzzle, many in the industry are turning to advanced testing and analytical technologies. When coupled with best practice methods, these solutions can deliver real-time intelligence and deeper insights to optimise product development, formulation, and processing.

Safety analysis, process monitoring, and partnering are three key areas within meat processing. In this article, we will outline how these tools are used to increase profits, optimise processes, and ensure excellence.

Safety first

For decades, the occurrence of foodborne pathogens, such as shiga-toxin producing E. coli, salmonella and Listeria monocytogenes, have been a costly, long-term challenge for many food sectors and remain a serious health concern around the world. While some cases of foodborne pathogen infections may be mild, others can be severe. It is critical to stay up to date with, if not ahead of, timely pathogen testing.

The European Centre for Disease Prevention and Control (ECDC) recently linked meat, poultry, and seafood to 30% of all foodborne pathogen cases. As such, governments have taken steps to ensure consumer safety with strict and regularly updated regulations and safety systems.

One such system is the Hazard Analysis and Critical Control Point (HACCP). Implementing HACCP procedures and preventive controls is the crucial starting block when creating an all-encompassing food safety and quality plan.

Furthermore, when underpinned by Good Manufacturing Practices (GMPs) and reliable standard operating procedures (SOPs), HACCP systems help address all food safety concerns throughout the supply chain – from raw material production to finished products – and allow processors to show their control over biological, chemical and physical hazards.

These monitoring and improvement plans are vitally important to the meat industry in helping to drive proper understanding and compliance and as ways to reduce potential foodborne pathogen contamination.

Within these preventive controls, microbiological testing of meat products is used by processors to validate, verify and ensure the integrity of process control in their HACCP system. Targeted screening for key pathogens form the core of a food safety plan. There are key attributes of a high-performance pathogen detection system, including speed, throughput, ease of use and specificity of the method.

Newer methods have focused on improving ease of use, reducing the number of hands-on steps while not requiring the same highly trained personnel to carry out as many of their predecessors – all positively impacting the profitability of a meat process. As a result, companies are actively seeking out and need rapid, intuitive and cost-effective methods for detecting these common pathogens and more.

Current pathogen testing solutions are divided between traditional culture methods, immunoassays and molecular diagnostics testing. As such, for meat stakeholders, it is important to ensure the correct workflow for your needs is implemented in your food safety plan.

Previously, many companies favoured molecular testing due to its speed and were willing to cover the increased costs to minimise product hold times. However, new generations of immunoassays provide a reliable and cost-effective pathogen solution with a time to result that matches molecular technologies.

These innovations aid the optimisation of overall workflows and provide strong foundations for easy scale-up, an ability molecular-based assays currently lack.

Consistent quality is key

Whether processing meat or creating rendered products, consumers and customers expect consistent, quality products. Material throughput is high in these plants meaning real-time, accurate measurement solutions are critical to meeting profitability while also maintaining quality and consistency.

Process Analytical Technology (PAT) is routinely employed to help meet these goals. One such technology, near-infrared (NIR), can be employed to measure several of the more critical components – moisture, protein, fat and ash. Newer, ruggedised models of these instrument are often placed directly in the processing line and provide real-time, simultaneous, multi-component analysis as product flows through pipes, chutes, or on belts.

These in-line and on-line NIR instruments can be integrated into the plant's process control systems and PLCs thereby helping plant operators to detect issues earlier and produce products that consistently meet specifications. This not only reduces product variation, thereby improving customer satisfaction, but also allows plants to maximise use of costly ingredients and reduce labour.

Additionally, these instruments can be cloud enabled. Results and reports can be accessed remotely 24/7. The instruments can be administered from a central location reducing onsite need for technical staff and maximising corporate expertise.

Partnering right

Meat processors are constantly innovating and launching new products into the marketplace. As the product portfolio expands, so does supply chain complexity and the scope of food safety and quality risks. With many companies challenged by inefficiencies and lack

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of intuitive and easy-to-use technologies, partnering with a full-service instrument provider is an increasingly important factor.

Choosing a trusted technology and method development partner helps ensure your laboratory, production line and products remain at the forefront of innovation. All the complexities of the 21st Century food supply chains have left it highly vulnerable to physical, chemical and biological hazards. By working in collaboration and partnership, testing solution providers can help meat processors meet the requirements for safety, traceability and regulatory standards.

Ensuring your laboratory finds the correct testing and analysis technology partner is vital. Experienced, collaborative approaches to analytical workflow development help enable meat testing businesses to achieve robust, highly optimised methods that meet their specific needs and regulatory requirements.

With the high turnover rate within the meat industry, and often lack of experienced technicians, one key requirement from your solutions provider is ease-of-use. For example, when performing mineral and trace element analysis on your samples using inductively coupled plasma (ICP-OES), a complete solution provider can ensure the fastest assurance of the quality of your materials

This removes the need for high cost, time-consuming instruction on instruments and allows new staff to gain consistent results.

Improvements with every bite

The mission for the meat and poultry industry is to provide safe and nutritious protein to consumers across the globe. The diversity and complexity of its value chain, as well as its specialised food safety and quality needs, requires a variety of tailored analytical solutions to tackle and stay ahead of new challenges.

Government agencies have partnered with industry to deploy analytical surveillance tools, such as PulseNet from CDC, to investigate and trace foodborne outbreaks.

Next Generation Sequencing (NGS) now enables scientists and microbiologists to confirm, discriminate and speciate pathogenic bacteria that are detected with rapid screening techniques.

The complementary use of screening and confirmation technologies are an important part

of a pathogen testing programme. Another future consideration for the meat industry is the shift from traditional culture-based microbiology methods to rapid screening platforms. Other technologies, such as advanced, modern and versatile on-line NIR sensors, are gradually being adopted to optimise efficiencies and provide key nutritional and process control.

As cost and margin improvement increasingly become the focus for the future, rapid technologies and applications will grow significantly, especially automated analysis tools, featuring innovative immunoassay workflow solutions, which provide users with rapid and reliable results and allow decision makers to act quickly.

For stakeholders in this market, effective implementation of innovative testing solutions as part of your food safety plan can help your business stand out in the field. Ensuring consistent, safe high-quality foods can be challenging. However, by keeping a finger on the pulse of advanced laboratory analysis techniques, the industry can maintain quality and safety levels and help safeguard improved consumer health with every bite. ■

References are available from the author on request