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CASE STUDY

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FINDING THE CURE TO SAUSAGE SAFETY

High levels of food safety in the processed meat industry are essential to maintain consumer confidence in meat products. Recent outbreaks of food-borne illnesses caused by enterohemorrhagic *Escherichia coli* (EHEC) and *Salmonella kedougou* in cured sausages in Norway further highlights the need to enhance the safety of processed meat products. As such, Norwegian food research institute, Nofima Mat is using bacterial enumeration technology, including the Whitley Automated Spiral Plater (WASP, Don Whitley Scientific) system, to examine and optimise methods by which EHEC bacteria can be eliminated from cured sausages, without compromising on the taste and quality of the finished product.

A particularly dangerous and pathogenic strain of *E. coli*, EHEC has been previously been associated with food-borne outbreaks traced to undercooked hamburgers, unpasteurised apple juice or cider, salad, salami, cured sausages and unpasteurised milk. Most outbreaks are caused by contaminated raw materials; however, outbreaks can also be caused by cross-contamination during processing. The risk of outbreaks from products contaminated with EHEC is high, since as few as 10-100 bacteria can be sufficient to cause illness. The EHEC bacteria produce toxins that can damage the lining of the intestine and cause anaemia and stomach cramps. Moreover, they can



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lead to serious complications including haemolytic uraemic syndrome (HUS), which can cause kidney failure. As such, EHEC outbreaks can have severe consequences for the people affected, as well as significant implications for healthcare services and the meat industry.

To reduce the risk of EHEC outbreaks within the cured sausage industry, Nofima Mat's four-year project aims to provide information to the meat industry on how to produce safer Norwegian cured sausages. With potentially far-reaching safety implications for the meat industry as a whole, the team is investigating the ability of EHEC to survive both during meat processing and in the final sausage product. As such, the research team inoculates sausages with EHEC then subjects several samples from each sausage to different methods of destroying the bacteria, for example high pressure treatment.

Bacterial enumeration technology, such as Don Whitley Scientific's WASP system, enables the team to accurately evaluate the methods for the elimination of EHEC. Moreover, the equipment allows the precise calculation of the applied bacterial inoculation levels, as well as the levels of bacteria in the spiked sausage samples. Since even low levels of EHEC can cause illness, the processing and storage parameters being tested need to kill the bacteria, rather than just preventing it from proliferating. Moreover, the equipment and procedures that are used have to be accurate and allow for the standardisation of laboratory testing procedures.



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When it comes to testing bacterial levels, it is important to select the right equipment and develop the most accurate and efficient procedures. In particular, where high bacterial loads are used or expected, serial dilutions allows the counter to visualise individual colonies. However, this can introduce a number of errors, including mistakes during dilutions and over-confluent plates which can prevent the user from counting the colonies effectively. In addition, the manual spreading and handling of bacterial plates adds considerable time, and therefore cost, onto a procedure.

Nofima Mat selected the WASP spiral plating system to eliminate the potential for sampling errors and provide automation, repeatability, flexibility and standardisation of the procedure. This system eliminates the need for sample dilutions by controlling the liquid sample deposition onto the surface of a rotating agar plate via a stylus. By reducing the amount of sample that is plated onto the agar as the stylus moves towards the edge of the plate in an Archimedes spiral, a three-fold logarithmic dilution can be achieved which is equivalent to a thousand-fold dilution. To further streamline the procedure and reduce the risk of cross-contamination, these high performance systems incorporate an automatic cleaning cycle, allowing time to remove the inoculated plate and prepare for the next sample.

The team has discovered that both process and ingredient parameters affect how safe the sausages are. Sausages with a high level of nitrite, salt and sugar develop less E. coli. In addition, the conditions under which the sausages are stored after



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manufacture also affect the survival of the bacteria. With this in mind, it is important that sensitive and reliable equipment continues to be used to test how the different parameters can be optimised to increase the safety of the product.

With the food safety of paramount importance to human health, the accuracy afforded by bacterial enumeration systems provides a valuable tool to improve testing procedures and safety within the wider food industry. Establishing the key parameters to eliminate the EHEC bacteria in cured sausages will, when implemented correctly, help to further ensure the safety of Norwegian consumers. Moreover, applying the bacterial enumeration procedures and the lessons learnt from the production of safer cured meat products to other food industries will help reduce the risk of food-borne illnesses as well as enhancing consumer confidence.

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Editor's note

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