

Food Safety INSIDER

Progress Starts Here

- 34** Meeting New Maximum Residue Limits
- 36** Automated Sample Preparation Coupled with Mass Spectrometry Detection for Food Matrices
- 38** Using SPME and GC-MS/MS to Measure Pesticides in Green Tea
- 40** GC Column Selection—Optimize Your Analysis
- 42** The Food Safety Enhancement Act: How a Laboratory Information Management System (LIMS) Can Help
- 44** An Effective Alternative to Bulk Liquid Media Preparation
- 46** Automation and Cost Savings Using Photometric Analysis
- 48** See What's Below the Surface with Guided Microwave Spectrometry
- 50** Testing for Irradiated Food to Ensure Quality
- 52** Solutions for Food Safety Testing

The Challenges Are Great and the Needs Are Urgent

As the world leader in serving science, Thermo Fisher Scientific provides products found along every link in the food chain. The basis of our Food Safety Program is to share knowledge and provide solutions for four principal questions involving food safety:

- What are the latest regulations?
- What is the impact of these new regulations?
- How can you help me improve the performance of my operation?
- How can you help me improve throughput and reduce costs?

Recent events and requests have led us to add an additional requirement:

- How can you help me deal with emerging risks?

As food safety professionals, we have historically looked at food safety in the context of the effects of regulatory changes, contamination and recalls, performance improvement and technological progress. In addition to these issues, this year we are faced with significant environmental variables, such as volcanoes and oil spills, which pose risks to our food supply now and in the future. Economic adulteration and food fraud have become part of our vocabulary. We have to be prepared to address these emerging risks now, as the world will look to the scientific community to identify the source and measure the effects of these issues with the goal of ensuring the safety of our food.

To meet these challenges, we offer tools to develop methods that detect contaminants suspected in adulteration and food fraud, tools for traceability and the means to verify authenticity, as well as solutions addressing such areas as nutrition and ingredient analysis.

We are continually advancing our knowledge and developing more of the solutions you need to address these challenges. Our advanced screening tools are designed to increase capability and throughput. Intuitive software is easier to use and able to identify a greater variety of contaminants. Software systems are able to provide track-and-trace for products or samples for unquestionable traceability. Higher resolution and accurate mass instruments of analysis aid in detecting adulteration and enable verification of authenticity. In addition, we have recently opened a Food Safety Response Center to aid the food safety industry in rapid method development in the event of a chemical food contamination crisis: www.thermoscientific.com/fsrc.

Over 35,000 Thermo Fisher Scientific employees around the world are dedicated to serving science, including existing and emerging challenges in food and environmental safety. The following pages showcase the diversity of our solutions, and we invite you to learn more by visiting our new Thermo Scientific brand Web site, www.thermoscientific.com. When it comes to food safety, we are up to the challenge and understand the urgency.



A handwritten signature in black ink that reads "Gerry Broski". The signature is fluid and cursive.

Gerry Broski
Food Safety Marketing Director
Scientific Instruments Division
Thermo Fisher Scientific

Testing the limits

New contaminants and adulterants move through the food chain creating emerging risks and concerns about the safety of the food supply. Regulation and litigation force suppliers and manufacturers to push the limits of detection, while economics mandate greater efficiency. Our instruments screen and detect trace levels of residues and contaminants, and minimize sample prep, dramatically reducing analysis from days to minutes. We'll take you farther, faster in your search for consistently superior results for virtually any food safety hazard. Take advantage of our expertise and gain a competitive edge.

farther, faster

• driving bold progress across food safety • www.thermoscientific.com/foodsafety



Meeting New Maximum Residue Limits

Internationally, food safety organizations are struggling to meet a wide variety of new pesticide-monitoring regulations as food sources and markets become globally diverse. Governments and trade organizations are increasing the number of pesticides that must be screened for and lowering



maximum residue limits (MRLs), leaving food producers scrambling to respond.

International regulations on MRLs of pesticides in food now cover hundreds of individual components—Japan's MRL list has over 800 compounds—at levels down to parts per billion (ppb). Meeting the expanded requirements has forced food safety teams to address a variety of new technical and budgetary issues by turning to liquid chromatography/mass spectrometry (LC/MS) instruments to run multi-residue analytical methods.

More than 800 regulated pesticides can be analyzed by LC/MS methods; however, LC/MS multi-residue methods can be challenging. Issues can include the following:

- Reducing the matrix effect on method performance
- Meeting analytical figures of merit for new regulations and standards
- Increasing throughput to accommodate higher workloads
- Streamlining the method development, data collection and reporting workflow

Thermo Scientific instrumentation and software can help food safety professionals face such challenges and improve the productivity of LC/MS analyses in residue laboratories. Thermo Scientific TraceFinder software coupled with TSQ Series technology simplifies the food testing workflow and shortens method development time. For water and beverage testing, the Thermo Scientific EQuan MAX system is a complete LC/MS analysis platform that improves productivity by reducing sample preparation time from days to minutes. These integrated solutions are ideal for performing simultaneous targeted multi-residue screening assays that include both quantitation and confirmation of compounds.

Precise, Versatile and Robust Quantitation

Triple-stage quadrupole detection technology coupled with chromatography offers improved throughput, confidence and reduced cost-per-analysis, making it a powerful tool for food safety testing. This detector technology measures the mass of target molecules and their unique reaction ions for both quantitation and residue identity confirmation. The Thermo Scientific TSQ Series triple-stage quadrupole mass spectrometers are powerful, sensitive and robust instruments designed to meet the demanding requirements of modern food safety laboratories. The TSQ Series instruments share several features that provide higher sensitivity and lower detection limits, making them well-suited for regulated environments like food safety.

Simplified Workflow

TraceFinder™ software simplifies the analysis of residues in food, water and beverage samples. Its menu of preconfigured methods and report formats simplifies routine contaminant screening, helping laboratories meet increasingly stringent monitoring requirements and boost productivity.

To create a method for targeted screening and quantitation, users simply choose the test, build the sample list, choose the report options and submit the samples for analysis. Users access the built-in SRM library and choose the LC/MS conditions to create the desired method.

Reduced Matrix Effects

SRM is the primary technique used with a triple-stage quadrupole mass spectrometer for quantitative analysis. However, selection of a precursor ion at a normal unit (1 amu) resolution often suffers chemical noise interferences from endogenous biological and environmental matrices.

The TSQ Series LC-MS/MS instruments offer increased resolution using highly selective reaction monitoring (H-SRM). By removing isobaric chemical noise, H-SRM increases signal-to-noise, improving limits of quantitation and providing higher-confidence results. H-SRM reduces the possibility of false positives, even in heavy matrices, without sacrificing sensitivity.

Increased Productivity

Sample preparation is a bottleneck in many residue laboratories. It can typically take 24–48 hours to extract, prepare and pre-concentrate samples for LC/MS analysis. EQuan MAX™ performs online sample extraction and LC/MS analysis of water and beverage samples, saving the analyst days in terms of off-line sample preparation time.

Simultaneous Quantitation and Confirmation

The Thermo Scientific Quantitation-Enhanced Data-Dependent MS/MS (QED-MS/MS) scan function increases throughput by providing simultaneous quantitation and structural confirmation. The acquired QED-MS/MS data can be subsequently searched against a built-in library of well-known contaminants for further structural confirmation.

Conclusion

TraceFinder software, coupled with TSQ Series technology, enables users to quantitate and confirm residue contaminants in food and beverage samples either by direct injection or by online sample extraction with the EQuan MAX system.

Automated Sample Preparation Coupled with Mass Spectrometry Detection for Food Matrices

Every food analysis starts with sample preparation, which is widely accepted as one of the most critical steps of food-related liquid chromatography/mass spectrometry (LC/MS) analysis. Currently, increased demand for higher throughput, accuracy, reproducibility and lower matrix interference from food analysis laboratories has made sample preparation one of the largest bottlenecks. In addition, in the course of monitoring multiple chemical contaminants in food, it is very common to test a variety of matrices, often requiring multiple sample preparation and/or LC/MS methods.



Current Methods

Currently, liquid/liquid extraction and solid-phase extraction (SPE) are two of the most widely used methods to isolate and/or enrich target analytes from food matrices. When done manually, these offline techniques are often labor-intensive, time-consuming and costly, resulting in low sample throughput and sometimes poor reproducibility.

TurboFlow Technology

Thermo Scientific TurboFlow technology is capable of yielding generic methods for a wide-range of analytes and matrices. An LC/MS system (Thermo Scientific Transcend TLX system) powered by turbulent flow chromatography (TurboFlow™ technology) was utilized to separate analytes from various matrices prior to MS (or MS/MS) analysis. The system injected the raw sample directly onto a narrow diameter (0.5 mm) TurboFlow chromatography column packed with large particles. Turbulence is created inside the column by high linear velocity and large particles, which force large molecules to quickly flow through to waste while retaining the small molecule analytes. The technology is an improvement over traditional offline SPE because it utilizes reusable extraction columns in a closed system, reducing the time required for offline sample preparation from hours to minutes. It also allows automatic removal of proteins and larger molecules

in complex mixtures by combining turbulence, diffusion and chemistry. By directly injecting food samples into the LC/MS system, food safety and quality laboratories can achieve significant analytical improvements by eliminating time-consuming and costly sample preparation steps. Herein, we use a method for antibiotic residue measurement in various meat and seafood matrices as an example.

Results

Fifteen analytes were selected to represent seven classes of common antibiotics: cephalosporins, fluoroquinolones, sulfonamides, tetracyclines, β -lactam, aminoglycosides and macrolides, which range from polar to highly non-polar. Five different matrices (i.e., beef, chicken, pork, turkey and salmon) were tested. The results indicated that all the analytes were well separated and the carryovers were minimal. Matrix-matched calibration standards showed good linear responses for all of the analytes investigated. In addition, the matrix blind assay shows that all compounds have acceptable recovery in all five studied matrices, indicating that current methodology is generic for a wide range of antibiotics measured in various food matrices.

Summary

Automated online sample preparation utilizing turbulent flow chromatography coupled with LC-MS/MS and complementary techniques have gained popularity in the food safety arena. This online TurboFlow method is generally matrix blind for five tested meat and seafood matrices. Unlike traditional SPE, the current strategy is generic for a wide range of antibiotic compounds.

©2010 Thermo Fisher Scientific Inc. All rights reserved. All trademarks are the property of Thermo Fisher Scientific Inc. and its subsidiaries. Copyrights in and to the speedometer image are owned by a third party and licensed for limited use only to Thermo Fisher Scientific by Shutterstock.



Speed without compromise.

In business, time is money. But where food safety and global health intersect, accurate data is critical.

With patented automated online sample preparation and unique multiplexing technology, the Thermo Scientific Transcend System can help you do both – accelerate your mass spectrometry workflow, without compromising data quality or sensitivity.

Powered by Thermo Scientific TurboFlow technology, the Transcend™ system reduces sample preparation time by up to 95%. Increase throughput by up to four times, with a system that gives you reliable results in a fraction of the time.

Visit www.thermoscientific.com/transcend to discover speed without compromise with the Transcend system.



The Thermo Scientific Transcend System

Eliminate time-consuming sample preparation and increase your throughput by up to four times.

Moving science forward

Thermo
SCIENTIFIC

Part of Thermo Fisher Scientific

Using SPME and GC-MS/MS to Measure Pesticides in Green Tea

Food laboratories continue to be asked to meet lower detection limits over a wider range of compounds and matrices. Governmental regulating agencies are adding more compounds and lowering the maximum residue limits (MRLs) for those already in existence. MRLs are safe limits that restrict the maximum levels of a pesticide present on a food commodity after appropriate and authorized use of that pesticide.

A typical workflow consists of sample preparation, extraction and instrument analysis. A key factor in improving sample throughput and providing a robust analysis begins with sample extraction and concentration.

Solvent consumption and extraction time can be reduced significantly by the use of solid-phase microextraction (SPME). SPME is a fast and simple sample preparation method where the use of solvents is not necessary and detection limits approach parts per trillion (ppt) levels. The application of SPME can also eliminate one of the traditional extraction steps.

This article will highlight an in-line sample extraction and concentration technique for multi-residue pesticide analysis coupled with a Thermo Scientific TSQ Quantum XLS triple quadrupole gas chromatography-mass spectrometer/mass spectrometer (GC-MS/MS) that can perform both screening and confirmation using selected reaction monitoring (SRM) or multi-reaction monitoring.

The TSQ Quantum XLS™ delivers femtogram-range limits of detection while improving laboratory efficiency and throughput. The robust design of the system offers greater flexibility, high-speed data acquisition and more sample runs.

Experimental Conditions

Green tea can be used to demonstrate a matrix that has a large number of interfering compounds.

Analysis is optimized using a Thermo Scientific TRACE GC Ultra with a programmed temperature vaporizer (PTV) inlet, a TriPlus™ autosampler configured for SPME, sold under license from Supelco®, and TSQ Quantum XLS GC-MS/MS.

Chromatographic separation is achieved with a Thermo Scientific TR-Pesticide II 30 m × 0.25 mm × 0.25 μm column with a 5m guard column. The guard column was placed through the transfer line and into the source of the MS.

Sample Preparation

The first step is to prepare the sample by homogenizing dry tea leaves in a blender. One gram of sample is weighed into 20-mL volatile organic analysis vials. An aliquot of the internal standard solution was added. After the addition of the standards to the dry tea, 3 mL of a 1% methanol solution saturated with NaCl is added. The vial is then capped, gently swirled and placed in the autosampler rack.

SPME Conditions

A 100-μm polydimethylsiloxane fiber is recommended for this experiment. The fiber is exposed to the headspace of the vial, while the sample was agitated and heated to 90 °C. After 30 minutes, the fiber is placed into the inlet and desorbed for 6 minutes.

Injection

The injection is performed utilizing a PTV inlet. The initial injection temperature was 75 °C and ramped to 250 °C at a rate of 2.5 °C/second, held

for 3 minutes, then increased to 280 °C at 14.5 °C/second and held for 20 minutes.

Separation

Chromatographic separation can be achieved using the TR-Pesticide II, a 5% diphenyl/95% dimethylpolysiloxane column. The guard column is inserted through the transfer line into the source of the MS, thus reducing column bleed. The GC oven program is as follows:

- Initial temperature: 90 °C, 5.0 min.
- 25 °C/min. to 180 °C
- 5°C/min. to 280 °C
- 10 °C/min. to 300 °C
- Final hold time of 2 min.

Detection

Tea contains large amounts of aromas, flavors and polyphenols as well as caffeine that can interfere with the detection and identification of the pesticide residues.

SRM is a vital analysis technique for a triple quadrupole analyzer:

1. The first quadrupole, Q1, isolates one mass. This is the precursor ion. This is the same process that is used in a single quadrupole in selected ion monitoring mode.
2. The second quadrupole fragments the structure of the selected precursor ion.
3. In the third quadrupole, the fragments from Q2 are mass analyzed. One of the product ions is selected for detection.

After retention times are determined in full scan, a timed-SRM method can be constructed to analyze the compounds. Calibration curves should be analyzed in individual vials to prevent the SPME fiber from becoming saturated.

Results

The calibration standards resulted in a calibration curve from 1 to 2,000 ng/g (ppb). The linearity for most compounds was r^2 greater than 0.995. Detection limits from the calibration curve demonstrate results at levels at or below those required by international regulators for most compounds.

The TSQ Quantum XLS paired with the TRACE GC Ultra delivers excellent results at low concentrations for the pesticide residues analyzed in the green tea following in-line SPME sample preparation. Using the instrument's SRM functionality allows the user to identify, confirm and quantify a wide range of concentrations in one analysis. Calibration curves for most of the pesticides studied meet a linear least squares calibration with a correlation coefficient of r^2 greater than 0.995. One or two ion ratios can be used to confirm each pesticide. The TSQ Quantum XLS is able to meet the international regulatory requirements for low-level detection, confirmation and quantitation for the analysis of pesticides in matrices without the need for manual extraction techniques.

< 1 ppb

The identification of trace levels of chemicals, such as pesticides, is challenging. Achieving precise answers while maintaining lab productivity more so. One GC/MS is driving progress in meeting analytical challenges like these. The new **TSQ Quantum XLS**, with sensitivity in the low femtogram range, is the world's most sensitive triple quadrupole. Coupled with the ability to precisely quantitate, and confirm over 1000 compounds in a single analysis, our GC/MS systems also make your lab the most productive.

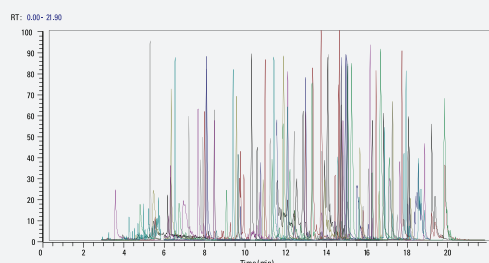
superior sensitivity

- see the full breadth of bold progress at • www.thermoscientific.com/quantumxls



TSQ Quantum XLS
Precise, sensitive, productive
triple quadrupole GC-MS/MS

- Increased sensitivity
- Greater resolution
- Precise, accurate results
- Meets China, EU, Japan and US regulations



Thermo
SCIENTIFIC

GC Column Selection— Optimize Your Analysis

www.thermoscientific.com/chromatography

When selecting a gas chromatography (GC) column for your analysis, it can often be difficult to choose the most appropriate column because of the wide range of options. However, the choice can be simplified by considering a number of questions about the planned separation. This section provides useful information to help you determine the most suitable column for your analysis.

Method Development Considerations

When first developing a method, you should consider these column characteristics to determine the best column for the separation.

- A. Column Phase
- B. Internal Diameter
- C. Film Thickness
- D. Column Length

		Film Thickness (µm)					
		0.1	0.25	0.5	1	1.8	3
Internal Diameter (mm)	0.1	250	100	50	25	14	8
	0.25	625	250	125	63	35	21
	0.32	800	320	160	80	44	27
	0.53	1325	530	265	133	74	44

Phase ratio (β) of common column dimensions

A. Column Phase

In GC, the separation of two analytes occurs due to differences in their interactions with the stationary phase; therefore, a phase must be chosen that matches the properties of the sample. For example, if the components have different boiling points (greater than 2 °C), a non-polar column, such as the TG-1MS, is recommended. If the products differ primarily in their polarities, then a polar column, such as the TG-WAXMS, will be ideal.

If you know the particular class of your sample, please refer to the column selection by application for a recommended phase. Always select the least polar column that will perform the separation.

B. Internal Diameter

The selection of the internal diameter (ID) is often determined by the instrument or detection method. Most modern GC equipment will accommodate most column sizes. With a larger internal diameter, column sample capacity increases, but resolution and sensitivity decrease. Conversely, a smaller ID column can improve resolution and sensitivity, but with the drawback of reduced sample capacity and a greater need for sample preparation. It is a good idea to find a similar application that gives separation of the desired components and use this as a guide.

C. Film Thickness

Increasing the film thickness increases the sample capacity of the column and slows the elution of the peaks, which can help during analysis of volatile compounds. A thicker film also reduces the potential of overloading the column, thus improving the resolution. However, a thicker film can be more sensitive to degradation. The same component will elute at a higher temperature on a thick film compared to a thin film.

Compounds with high boiling points or those with high molecular weights should be analyzed using a thin film to improve resolution and avoid unnecessarily long analysis times.

Another factor to consider is the phase ratio (β), which is calculated using both the ID and film thickness (the ratio of a column's volume of stationary phase to mobile phase) in the following equation:

$$\beta = \text{ID } (\mu\text{m}) : 4 \times \text{film thickness } (\mu\text{m})$$

The phase ratio can be used in two ways:

1. To categorize the best dimensions for an application:
 - a. For volatile samples, $\beta < 100$
 - b. For general samples, $\beta \sim 250$
 - c. For high molecular weight samples, $\beta > 400$
2. To transfer an analysis from a column of one ID to another without changing the method substantially, choose a column with a similar β value, as this will have similar retention properties.

D. Column Length

A longer column length will provide greater efficiency and resolution, but this is not a linear relationship. Resolution is proportional to the square root of column length, so doubling the column length will increase resolution by approximately 40%. However, increasing the column length will also increase the retention time. Double column length equals twice the analysis time. Generally, it is recommended to use the shortest column that will perform the desired separation.

Additional Considerations

Several generalizations regarding GC columns exist that you might rely upon when in doubt. First, 95% of all GC columns used are either TG-1MS-, TG-5MS- or TG-WAXMS-type columns. A good starting column is a 30 m x 0.25 mm ID, 5% phenyl column with a 0.25-µm film thickness, such as the TG-5MS. This is a non-polar column, which separates predominantly on boiling point, but has some polar characteristics.



© 2010 Thermo Fisher Scientific Inc. All rights reserved.

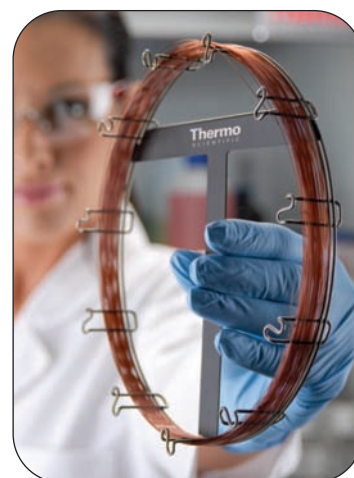
The right tools, separation after separation.

Our unmatched product portfolio and experience in applications and methods development will guide you through any challenge, on any instrument. Discover the most comprehensive array of chromatography solutions available, including Thermo Scientific TraceGOLD GC columns for:

- Ultra low bleed, ensuring minimal instrument downtime and extended column lifetime
- Superior inertness, providing improved sensitivity, especially for active compounds
- Excellent column to column reproducibility, guaranteed

From sample preparation to separation and analysis, our tools help you achieve repeatable, predictable results – separation after separation.

Learn more at www.thermoscientific.com/tracegold



Redefine your expectations for GCMS with Thermo Scientific TraceGOLD GC Columns

Moving science forward

Thermo
SCIENTIFIC

Part of Thermo Fisher Scientific

The Food Safety Enhancement Act:

How a Laboratory Information Management System (LIMS) Can Help

In 2009, the Mexican tomato business was devastated because tomatoes were wrongly blamed for an outbreak of *Salmonella* that was actually caused by tainted jalapeño peppers. Without proper systems in place to provide traceability, there was no way to identify the contamination source. Several people died, many more became ill and a major business was damaged due to a lack of information. In cases like these, the price for food producers is not only lost revenue due to product recalls, but more importantly, they experience a loss of trust among the buying public and governments around the world. Unfortunately, in most food contamination occurrences, the grower or producer has inadequate methods in place to trace the original source of the contamination.



Current Food Safety Challenges

In the United States, the oversight of food has fallen under a fractured network of agencies responsible for different parts of the production process, from site inspections and safe processing methods, to the documentation of calorie counts and ingredient listings. Some grown and produced foods fall under the auspices of the U.S. Food and Drug Administration (FDA), while food groups that contain a combination of meat, dairy and produce have fallen under the oversight of the U.S. Department of Agriculture. Compound this regulatory environment with the fact that staffing for food inspections has been inadequate compared with the volume of inspection needed to manage safe production. This lack of manpower and the separation of responsibilities has exacerbated the ineffectiveness of the regulatory agencies and caused confusion among the consuming public. U.S. President Barack Obama has stated that the current regulatory framework "...is a hazard to public health."

"[The Food Safety Enhancement Act] would indeed transform our nation's approach to food safety from responding to outbreaks to preventing them. It would do so by requiring and then holding companies accountable for understanding the risks to the food supply under their control and then implementing effective measures to prevent contamination."

—Margaret A. Hamburg, Commissioner, FDA (June 3, 2009)

The Proposed Legislation

The Food Safety Enhancement Act (FSEA)—as passed in the U.S. House of Representatives—updates food safety laws to improve the FDA's supervision of the nation's food supply. The legislation requires more frequent inspection of food facilities, improves inspector access to records and orders facilities to develop and implement safety plans to identify and protect against hazards. The FDA is to establish minimum standards for the safety plans. The bill compels all food plants to register with the FDA and pay an annual fee that, along with fees for food inspection and recall, will

help pay for the expansions of oversight. Along with other measures that enhance the FDA's ability to prevent the distribution of unsafe food, the FSEA authorizes the agency to order mandatory food recalls of products that may cause adverse health consequences or death. Finally, the bill makes food origin easier to trace, improves oversight of fresh produce and imported foods and boosts penalties for violations of food safety laws.

FSEA—Implications for Food Producers

For food producers that do not have automated systems for monitoring their processes or do not have methodologies in place to verify batch content or origin of raw materials, the FSEA may impose new strictures which would have an immediate impact on their business.

For example, *if the law passes and is signed into law:*

- All food producers will be required to register for mandatory inspections. Registration will identify every person involved in the production process so that a food tracing system can be established.
- All records will be required to be available on demand by the Secretary of Agriculture and/or delivered to the agency to verify that safety requirements and processes are being followed.
- Fees may be imposed on food producers, including annual inspection fees, as well as additional fees if a facility fails inspection and requires surveillance by the agency. Civil penalties may be imposed for those facilities involved in product recalls that include not only monetary fines, but also plant shut-downs and imprisonment.
- All foods and commodities will require regular testing and reporting of results that show compliance to new science-based standards. Penalties may be imposed on facilities that falsify records or submit falsified records for the purpose of non-compliance.
- Food importers will be required to produce certificates of compliance to the standards and ensure that accredited laboratories conduct proper testing, or else those food items will be refused entry into the United States.

Prospects for FSEA Passage

The House has passed its version of the FSEA, but the Senate has been stalled in its consideration. While the Senate

www.thermoscientific.com/informatics

committee of jurisdiction approved a version of the bill, the text awaits consideration on the Senate floor. In part, the legislation is delayed due to extended consideration of health care reform, as well as the inclusion of tangential issues related to food packaging. At the time of writing this article, the Senate's current hope is to pass its bill before July 4th. Regardless of the timeframe, Thermo Fisher Scientific is available to help address new legal and regulatory requirements, no matter how and when new government rules are promulgated.

Employing a LIMS to Meet the Demanding FSEA Requirements

The most important, common thread throughout the FSEA is traceability. Laboratory Information Management Systems (LIMS) play a critical role in the traceability of quality in the production process from farm to fork, providing such capabilities as:

- Automated data collection from testing and delivery of the records of proof that are required for regulatory compliance;
- A secure environment for monitoring batch relationships between raw materials, processed materials and packaged goods;
- A centralized system that collects, stores, processes and reports all the data generated within food laboratories, allowing a complete overview of the quality of any product;
- Automated checks for out-of-specification results and identification of suspect products to prevent release pending investigation;
- Assurance that all (standard, fast turnaround and condition-sensitive) samples are handled and processed correctly.

Furthermore, a LIMS provides the producer with the knowledge that the quality of the product meets the standards set by the regulator, and it records that data for any subsequent inspection. Whenever required, auditors can review uniform compliance reports and the certificates of inspection stored within the LIMS to confirm consumer safety.

Ultimately, a LIMS plays a key role in the integration of the laboratory environment with critical enterprise systems to facilitate faster, more informed decisions. This makes laboratory data available to process control systems, giving managers immediate accessibility to results, as well as cascading any release data through to enterprise resource planning (ERP) systems.

LIMS-on-Demand—A New Alternative

For some food testing laboratories, commercial LIMS have been too costly for the businesses to absorb and support, forcing them to rely on inefficient manual and error-prone home-grown systems, spreadsheets or paper-based methods. Thermo Fisher Scientific has made the full functionality of LIMS available on-demand via the internet for a low, monthly subscription fee at www.limsondemand.com. LIMS-on-Demand is ideally suited for environments that require a robust solution for their laboratory data collection and reporting needs, but may not have the in-house resources traditionally associated with managing such a system. A top-tier hosting provider manages the system, relieving lab managers and information technology staff of software maintenance and configuration.

For companies with teams in multiple locations or those utilizing the services of external organizations, LIMS-on-Demand enables members to enter, view and share data and workflows, enhancing productivity and increasing opportunities for collaboration, requiring only a Web browser and internet connectivity to be able to access the system.



Traceability Solutions for Food Producers Worldwide

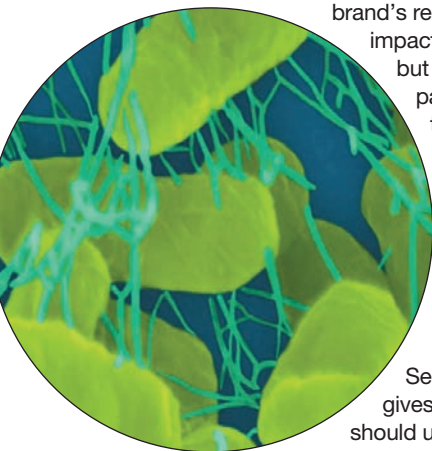
Molkerei Alois Müller produces more than a third of all yogurt eaten in the United Kingdom from the Market Drayton factory. The *Müller* UK labs focus mainly on production quality control. Every step in the process undergoes quality checks, which are managed and stored with the LIMS. *Müller* selected Thermo Scientific LIMS to manage their quality control (QC) data for raw materials, in-process and finished dairy desserts. The LIMS reduced the amount of error-prone manual paperwork processes and expedited testing, while providing the necessary reports and documentation for a complete audit trail during regulatory inspections. By using a LIMS, *Müller* is able to trend all data and make quality and safety decisions, as well as any necessary improvements, much faster and more reliably.

Sino Analytica in Qingdao City, China, is a world-class food analysis laboratory that provides contract analytical services to a wide range of food suppliers, trading companies and retailers from China and all over the world. *Sino Analytica* historically managed data manually in the laboratory with a monthly load of over 1,200 samples. The company chose Thermo Scientific LIMS to support its food safety contract laboratory and meet the internal quality standards and accreditation requirements. The LIMS has helped laboratory managers achieve faster assembly, collation and review of information and data relating to quality assurance and quality control (QA/QC) activities. The LIMS also demonstrates that the company meets the requirements of auditors and provides documentation for processing internal QC data.

Chr. Hansen in Hørsholm, Denmark, is one of the world's top food ingredient companies. The company standardized on Thermo Scientific LIMS across all of its six culture production sites in Denmark, France, Germany and the U.S. to ensure optimum quality control in starter culture production. The LIMS implementation has delivered considerable benefits, including real-time, automated entry and processing of laboratory data and fast extraction of results, leading to increased laboratory productivity and accelerated sample turnaround. *Chr. Hansen* has also integrated the LIMS with its existing ERP system so that test results authorized in the LIMS by lab personnel can be immediately available for the processing facilities' technicians and laboratory administrators. Contact us at marketing.informatics@thermofisher.com for more information.

An Effective Alternative to Bulk Liquid Media Preparation

Food pathogen testing is necessary to guard against releasing a contaminated product that could jeopardize the health of the consumer. Product recalls cost food and ingredient manufacturers millions of dollars each year. Recalls because of contamination will damage a brand's reputation because of lost consumer confidence. This impact usually extends to products not involved in the recall, but sold by the same manufacturer. The need to test for pathogens is the same for all food, regardless of whether the food is for humans or animals.



ALcontrol Laboratories is one of the largest laboratory service businesses in Europe, with laboratories in the United Kingdom (UK), Benelux and Sweden, offering services covering food, environmental, potable water, land, oil, asbestos and air testing. ALcontrol Food is a UK market leader in food analysis, with six laboratories throughout the UK.

ALcontrol Food laboratories are UK Accreditation Service (UKAS) group accredited to ISO 17025, which gives them substantial capacity and contingency capability should unforeseen circumstances arise. The UK laboratories hold independent supplier audits (ISAs) to facilitate analysis of modeling and simulation (M&S) requirements and UK Department for Environment, Food and Rural Affairs (DEFRA) approval for the animal feed industry. With a fleet of refrigerated vehicles across the network of laboratories, they provide customer sample collection throughout the entire UK. Their industry-leading electronic reporting system (AMIS) provides results as rapidly as methods allow, enabling customers to easily store, manage, report and perform trend analysis of large amounts of data. ALcontrol analyzes a vast range of sample types, from raw meat, raw fish, mechanically recovered meat and mycoprotein to milk, snacks, confectionery, ready meals, sandwiches, herbs and spices. Such a wide range of sample types necessitates a wide range of microbiological tests and methods. Enumeration tests, such as aerobic colony count, *E. coli*, coliforms and *S. aureus*, are routinely performed. Some pathogen analyses, such as *Salmonella*, *Listeria monocytogenes*, *Campylobacter* and *E. coli* O157, aim to determine the presence or absence of the organism. These tests require an enrichment process to ensure detection of even small levels in the product. With approximately 2.2 million samples analyzed each year, it is imperative that processes are as efficient as possible.

Bulk Liquid Handling

Buffered peptone water (BPW) is the main diluent used by ALcontrol in the preparation of samples. Each batch takes time to prepare in terms of weighing out media powder, measuring liquid and autoclaving and cooling bottles, which can take 4 to 5 hours. Staff availability, the number of runs per day and the number of autoclaves available all restrict the production of BPW. As the number of samples increased at the Shrewsbury laboratory

(now handling 170,000 tests per month), it was evident that the autoclave capacity for the manufacture of liquid media was becoming a limiting factor. The autoclaves were not coping well with running 24 hours per day, but the installation of further machines was not possible within the timescale required. After considering other ideas, such as prepared media options, Oxoid Dry-Bags™ provided an ideal solution. Following a short trial period, it was clear that they would fit well into current procedures, enabling an increase in media production and efficiency without heavy capital investment.

Easy to Use and Cost Effective

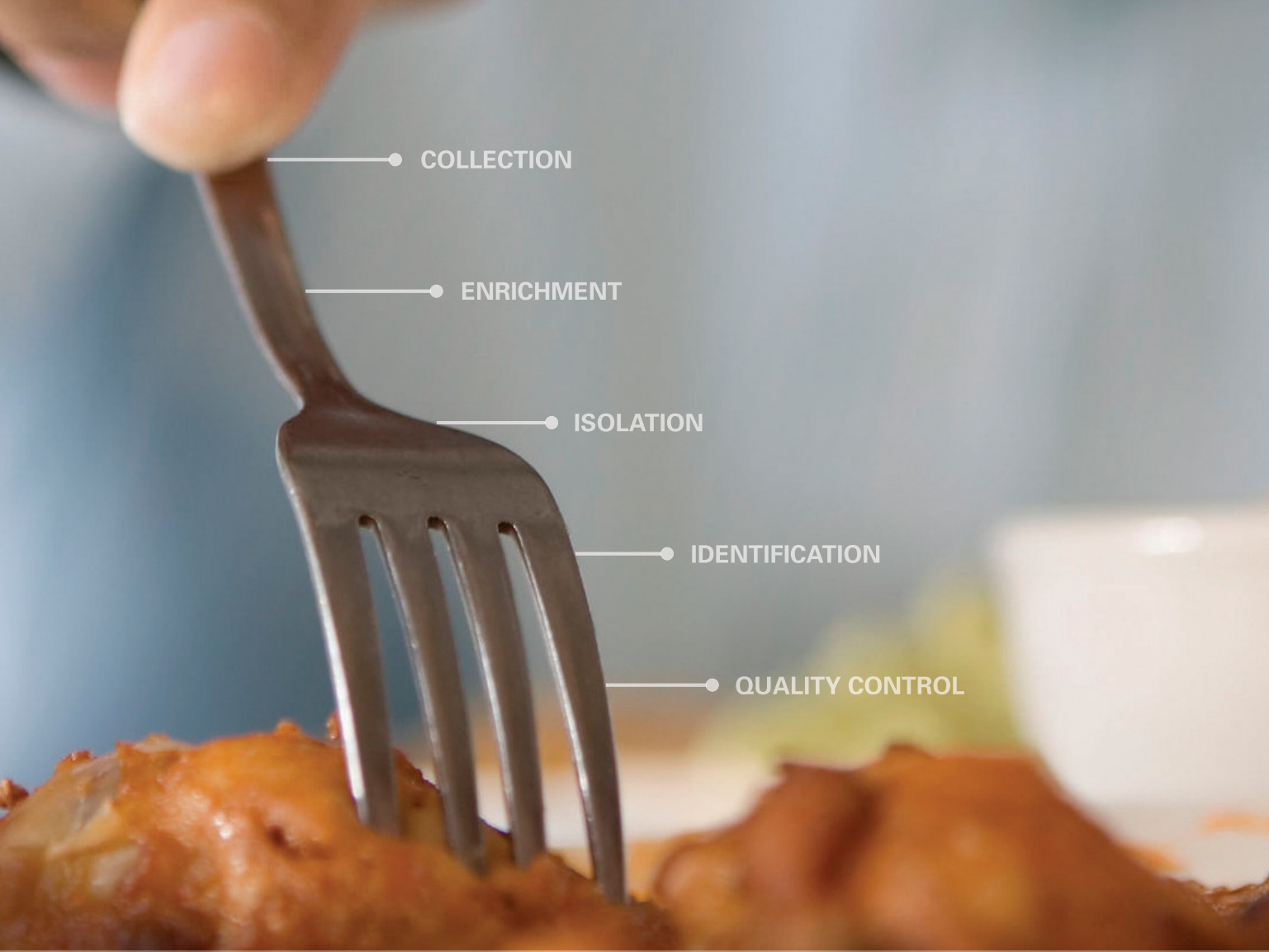
"We are impressed by the Dry-Bags' ease of use," says Paul Anderson, site manager at ALcontrol, Shrewsbury. "They fit directly onto automatic diluters for dispensing, thereby reducing the risk of contamination." As a disposable option, they eliminate the time and expense of recycling glassware associated with in-house media production. They offer cost savings in terms of running the autoclaves (300 L saves 3–4 autoclave runs) and by reducing the number of quality control checks necessary. (The batch numbers of the Dry-Bags change far less than those of in-house BPW, Paul notes.) All these factors lead to more efficient media production. "The performance pressures and wear and tear on the autoclaves is reduced," continues Paul. "The Dry-Bags stack neatly and tidily into existing laboratory crates and take up far less space than glass bottles. Media staff time is freed up to concentrate on other tasks, and the Dry-Bags have been incorporated into our production without having to make any changes to sample processes."

Enhanced Flexibility

"Perhaps more importantly, the media can be reconstituted in around 10 minutes, significantly reducing the lead-time of BPW production. This allows us to cope seamlessly with large fluctuations in workload, which are often typical of our business. They enable the laboratories to be highly flexible and respond efficiently to the media demands of variable sample through-put."

Availability

The Oxoid Dry-Bags are available through the Microbiology Division of Thermo Fisher Scientific. More information can be found at www.remel.com or www.oxoid.com.



● COLLECTION

● ENRICHMENT

● ISOLATION

● IDENTIFICATION

● QUALITY CONTROL

Serving up superior food safety solutions.

When it comes to keeping food safe, you need tests you can count on. That's why Remel and Oxoid products are with you every step of the way—from farm to fork. With a wide range of reliable tests and methods, you can help keep food free from *Salmonella*, *Listeria*, *E. coli* and other harmful microorganisms. Our products offer collection, dilution, enrichment, isolation, enumeration, detection, identification, and confirmation options. For more than 35 years, the Remel and Oxoid product brands have been trusted for providing quality products, on-time delivery, and superior customer support to help customers like you exceed food safety expectations.

Learn more at remel.com/food.

remel

Part of Thermo Fisher Scientific

Automation and Cost Savings Using Photometric Analysis

Like many other industries, changes in food safety and quality testing are often the result of the migration of existing technologies to the food testing laboratory. For decades, discrete photometric analysis has been employed successfully in clinical laboratories. Offering faster, more reproducible results with less sample waste, discrete analyzers have played a major role in the evolution and automation of clinical tests. More recently, this technology has been adapted to work with various environmental and industrial applications, including food and beverage analysis.



Efficiency and Productivity in Analysis

All food products require analysis as part of a quality management program; they are analyzed throughout the development process, during production and sometimes after a product has already been delivered to the market. Speed and automation are the key factors for labs that perform many tests and want to improve and simplify analytical procedures.

Thermo Scientific Gallery, a new, discrete photometric analyzer, is fully automated and conveniently sized, offering excellent analytical performance for colorimetric, enzymatic and electrochemical measurements. Several system parameters can be predefined for specific applications, and a wide variety of reagents help optimize the analysis in tests such as fermentation processes, ingredients in food samples and water quality.

Automated Operation

Gallery's high level of automation means that it is easy to operate. The analyzer arrives ready for immediate analysis; it doesn't need any warm-up time or reagent priming. Start-up and shutdown protocols are automated and, once loaded, the analyzer automates all necessary steps, providing a walk-away time of up to 2 hours. Sample pretreatment is minimal; generally, centrifugation or filtration is adequate to prepare the samples. Additionally, the low sample volume needed per test is one of the advantages of discrete analysis.

Several blanking possibilities are available to eliminate sample matrix effects. Results are flagged automatically in case of abnormal values, out-of-limit control values or repeats. Reporting is possible as printouts or electronically as PDF files. Spreadsheet reporting is also possible for further calculations.

Reliable Technology

Gallery provides an integrated platform for two measurement techniques, photometric and electrochemical (ECM), which can be run in parallel. Discrete cell technology allows for simultaneous measurement of several different tests for the same sample, eliminating method changeover time. Each individual reaction cell is isolated and temperature-stabilized, thus providing highly controlled reaction conditions. Gallery is able to achieve very low detection levels, and its sophisticated dilution features help to manage a wide concentration range without user intervention. Results are ready within minutes, translating to remarkable saving in hands-on time. The wavelength range covers filter configurations from 275 nm to up to 880 nm. The new, optional ECM unit supports conductivity measurements over a broad range and uses ion selective electrodes for pH measurement. Sodium and potassium determinations will be added in the future.

Flexible and Economical to Use

The instrument's flexible loading capacity, up to 45 samples or 30 reagents simultaneously, contributes to its convenience and ease-of-use. An on-board barcode reader enables automatic sample and reagent identification. Samples, reagents and consumables can be loaded at any time without interrupting the analysis in progress. Application parameters allow up to four reagent additions in each test, offering automation even for the most complex methods. Inventory management includes associated calibrations and reagent lot data.

In addition, Gallery's unique, low-volume cuvette design makes it economical to use. It guarantees low reagent costs and minimizes the amount of reagent waste. Cuvettes are disposable, so there is no need for washing to prevent carry-over.

Optimized System Solutions

System applications are available for different sugars, acids and alcohols, as well as for nitrate, phosphate, sulphate, calcium, magnesium, urea, ammonia and chloride. A wide range of calibrators and controls support the testing. The application data is loadable from a file or from a two-dimensional barcode by the barcode scanner.

Ready-to-use system kits eliminate time-consuming reagent preparation, allowing additional cost savings. Kit sizes and on-board stability are optimized, and bar-coded vials provide reliable and easy identification. Reagent usage and expiration date are automatically monitored in real-time.

Compact Design

Gallery's compact design occupies only a small footprint, facilitating installation in any laboratory. The analyzer is fully self-contained and does not require external water or drainage connections. Analyzer uptime is maximized by minimal daily and weekly maintenance. Although any laboratory would benefit from the use of a Gallery system, it is particularly attractive to laboratories with space limitations or for those who perform specific enzymatic testing, such as a small winery.

Summary

The Thermo Scientific Gallery is an automated system that allows users to simplify their food, beverage and water testing to realize both time and financial savings. Once loaded, the system allows an analyst to walk away for several hours and return later to find accurate, reliable results.

© 2010 Thermo Fisher Scientific Inc. All rights reserved. All trademarks are the property of Thermo Fisher Scientific Inc. and its subsidiaries.



Faster results for food and water analysis with the new Thermo Scientific Gallery bench top analyzer.

The Thermo Scientific Gallery is a discrete photometric analyzer with a wide range of applications for food, beverage, water and environmental testing and quality control. This fully automated system offers excellent analytical performance for colorimetric, enzymatic and electrochemical measurements.

The compact design occupies a small footprint and is fully self-contained. It offers a flexible loading capacity up to 45 samples or 30 reagents simultaneously. All necessary steps are automated, providing a walk-away time up to two hours.

The Gallery also offers a new optional electrochemical (ECM) unit using ion selective electrodes for pH measurement. Sodium and potassium determinations will be added in the near future.

For more information on this product, contact us by email at sales.industrial@thermofisher.com or call 1-800-232-3342.



**Thermo Scientific Gallery
Photometric Analyzer**

Moving science forward

Thermo
S C I E N T I F I C
Part of Thermo Fisher Scientific

See What's Below the Surface with Guided Microwave Spectrometry

Guided microwave spectrometry (GMS) has been a trusted method for constituent measurement for years. The technology is relatively simple: GMS uses low levels of microwave energy, less than 0.05 W, to precisely measure the dielectric properties of a product as the wave passes through that product. Since the microwaves pass through the entire product, GMS provides an intrinsic measurement of the whole product—not just the surface. Additionally, because the waves can be calibrated to measure more than one dielectric property, you can obtain a variety of repeatable measurements for feedback and control.



Designed for use in a process stream, the Thermo Scientific ϵ scan is an in-process analyzer that uses GMS technology to measure key variable constituents, such as moisture, fat, salt, protein, brix and more, in a variety of foodstuffs. This method provides precise, real-time measurements that let you know immediately whether your key ingredients are meeting your target set points. The advantage of this analyzer is that you will know when you need to adjust your ingredients to meet target set points—giving you better control and a better outcome. This saves you money by limiting the amount of “giveaway” of more expensive ingredients.

The GMS can also reduce waste and energy consumption. For example, when you have precise, instant information about a product’s moisture content, you may be able to reduce the amount of time the product spends in an oven to remove some of that moisture, thereby reducing the energy used to over-dry it.

GMS Uses in Food Safety

Another advantage of ϵ scan analyzer technology is how it can be applied to food safety measures. Many people think constituent measurement is related only to product quality; however, quality goes hand-in-hand with food safety. The ϵ scan analyzer uses guided microwaves to measure key constituent set points, such as moisture levels, acidity, salt concentration and water. As described below, these constituents can play a definitive role in determining shelf life, product stability and overall product safety.

Controlling Water Activity Levels

As one of the critical factors of food quality, water activity levels are measured regularly in most major food production facilities. Moisture content is related to water activity in a non-linear, substance and temperature-specific relationship known as a ‘moisture sorption isotherm curve.’ Depending on temperatures and conditions, the isotherms can predict product stability over time. Controlled water activity levels—whether through the addition of salt, sugar, freezing or drying—help create stable, safe food products by controlling microbial growth and increasing the shelf life of

food. Process measurement and control is critical to keeping the water activity low enough to prevent bacterial growth. The ϵ scan analyzer provides a reliable measurement of water activity so producers can ensure minimal bacterial growth long after the product has left their facility.

Concern about Salt Content

Health-conscious consumers are paying more attention to the effects that their salt intake has on their health. Growing concerns about the amount of salt in processed foods is driving consumers to demand lower sodium options from food manufacturers. The National Salt Reduction Initiative in the United States has called for food manufacturers to reduce salt content in products, which may put manufacturers in a difficult situation. Salt plays a prominent role in providing flavor and helping to ensure food preservation. While consumers want manufacturers to reduce salt, they are concerned about synthetic preservatives and artificial flavorings. Measuring salt in food products continues to be important to manufacturers—and the ϵ scan analyzer can provide a solution for accurate measurement and control of sodium in food.

The ϵ scan In-line Analyzer... A Reliable Process Solution

The Thermo Scientific ϵ scan analyzer uses GMS technology to provide real-time, accurate results that are truly representative of the bulk of the product—down to a fraction of a percent. You will have the data you need as your product moves through the process—so you know immediately if your content deviates from set points and your process needs an adjustment.

The ϵ scan analyzer allows for clean-in-place (CIP) but is also easy to disassemble and reassemble if required for a specific application. With no moving parts, the analyzer offers reliable, continuous operation in your product line. Also, because the system relies on microwaves for measurement, there is no obstruction of the product flow. Its rugged design ensures that the ϵ scan analyzer is robust and capable of handling the high-pressure environments that are typical for piped products.

Early controls at every step of the process can help prevent recalls and keep food at its highest quality levels. Incorporating the ϵ scan analyzer to measure ingredient levels can ensure that your product consistently meets the proper target control set points—for safety, quality and taste.

www.thermoscientific.com/escan



Turn instant feedback into fast payback.

Here's an idea you can take to the bank: Thermo Scientific **E**scan analyzer gives you instant in-line analysis of fat, protein, moisture and other key properties in your food matrix.

Escan™ analyzer uses Guided Microwave Spectrometry to see through the pipe and provide you with complete analysis of your entire product—not just the surface like NIR technology. It lets you know when you're in the zone and helps keep you there. It delivers the information you need to control the content of your mix and the quality of your product.

Discover how **E**scan analyzer can help you save time, money, and raw materials—with payback in as short as two months.

To learn more, call +1 (800) 227-8891. Email escan@thermofisher.com or visit www.thermoscientific.com/escan.



Thermo Scientific **Escan analyzer—**
The fast, easy and accurate way to measure key constituents in food as it goes through the pipe, so you can make corrections on the spot.

Testing for Irradiated Food to Ensure Quality

Ionizing radiation has been used for many years as a way to preserve foods by delaying spoilage and also to kill foodborne organisms that cause illness. Regulations on irradiation of food vary from country to country and sometimes within regions of the same country. Some countries have no legislation on the use of radiation while others ban it completely.



In certain cases, legislation may allow only certain foods to be irradiated for preservation purposes. An example of this partial allowance approach would be in Japan where it is permissible to irradiate potatoes to delay sprouting, but other foods or food components cannot be irradiated. Food components might include additives like spices or hops used in beer.

The Challenge

Many times, the label on the package is the only indication to a consumer that a food was irradiated. Reliance on labeling assumes that a label will always be present and not missing due to intentional removal, damage or neglect. Since irradiated food does not have any residual radioactivity or contamination, the use of a portable survey meter or "Geiger counter" will not indicate any increase in radiation. Irradiation of food is done with a high-energy radiation source, such as a ^{60}Co source or a linear accelerator, similar to a high power X-ray machine. This process is much like other products that are sterilized using radiation, such as disposable surgical products, band aids and syringes. Food that has been irradiated typically does not look any different or have a different texture or taste.

While irradiation of food offers health-related and economic benefits, there is concern by country health officials and business that food irradiation may be used to mask poor food quality and serve as a crutch to improper food handling and processing. These groups want to ensure that food and food components maintain a high level of quality. An example of low-quality ingredients might be spices that were not handled or stored properly and that contain bug infestations. Using irradiation to kill the microscopic bugs in the spice may make the spice edible and prevent it from causing illness, but the quality of the spice is still poor. Another example would be chicken or beef that has been improperly handled and has *Salmonella* or *E. coli*; while irradiation may kill the bacteria, there are still concerns because the product has not been handled properly.

The Solution

Instead of relying solely on label information, other techniques are utilized to confirm irradiation. While there are many methods of analyzing food and food substances for irradiation, thermoluminescence (TL) technology is widely used because it is highly conclusive and reliable. Other methods are not always conclusive because they do not have a definitive signal that is always present post-irradiation, leading to too many false positives or false

negatives. In Japan, the TL technique is the only method allowed by law as conclusive. In other countries, such as Germany and England, the TL method is the mainstay for food testing laboratories and government agencies.

The Thermo Scientific Model 3500 TL reader reliably performs irradiation testing and has been selected by Japan as the instrument of choice for evaluating food. The TL technique relies on the fact that food substances contain materials that are sensitive to radiation, and these substances can store the radiation signal for a reasonable period of time. When the food sample is heated, the material resets the atomic structure and gives off light that may be measured by an appropriate TL instrument. This light corresponds to the amount of dose received. A special process is used to distinguish between man-made or intentional irradiation from natural radiation sources such as the ground or space. This light is captured by a photomultiplier tube and digitized by the Photronics measurement system, which has a linear range of seven orders of magnitude, allowing the measurement of very small to large signals. Once the light, or glow curve, is captured, it is analyzed by the software specific for the irradiated food process.

Business Benefit

Various Ministries of Health, regulators, and food companies concerned about the quality of food rely on the Thermo Scientific Model 3500 and accessories as the first choice to ensure accurate results. In locations where irradiation of food is restricted or banned, the Model 3500 TL may be used in laboratories in both importing and exporting countries to provide certification that food products have not been irradiated, thereby preventing return of the product due to non-compliance. This saves money and ensures confidence in the quality of the food product being imported or exported.

Conclusion

The Thermo Scientific Model 3500 reader offers high sensitivity and reliability; the instrument will work in a rugged, heavily used environment for over 10 years. In addition, linear heating that gives more precise results, and an ability to go to higher temperatures than any other unit, are all reasons why we have the largest number of units sold worldwide for different applications along with the largest service and support network.



© 2010 Thermo Fisher Scientific Inc. All rights reserved.

You can't tell if it's been irradiated just by looking at it.
Is the quality exactly what is represented?

Relying upon a label may not be the best way to know for sure if a food product has been irradiated. Labels may be missing due to neglect, oversight or intentional omission. How can you be sure that the quality has not been compromised?

Thermoluminescence (TL) technology provides conclusive and reliable results. Our Thermo Scientific Harshaw Model 3500 TLD Reader is the standard instrument for food testing agencies and laboratories in many countries around the world.

For more information on our Thermo Scientific Harshaw TLD Readers and related irradiated food testing products:

+1 (800) 274-4212

www.thermoscientific.com/dosimetry



**Thermo Scientific Harshaw
Model 3500 TLD Reader**

Tested, reliable methodology to
determine food irradiation

Moving science forward

Thermo
S C I E N T I F I C

Part of Thermo Fisher Scientific

Solutions for Food Safety Testing

Today's food safety professional is involved in more than food safety testing; you are constantly required to explore new solutions for prevention, intervention and response. Fisher Scientific can help you formulate the unique solution that best fits your laboratory product and service requirements.

Our goal is to deliver complete solutions to help you meet rapidly changing testing requirements. We continually expand our product portfolio adding new technologies to support food chemistry, food biotechnology, microbiology, sample collection and preparation as well as the products you use everyday like chemicals, instrumentation and consumables.



Fisher Scientific's advanced Web site, www.fishersci.com, offers you more product selection tools, ordering tools and control of your funds. Browse our Food Diagnostics catalog and Wine Analysis Supply Guide for specialized diagnostic and testing products. These products adhere to industry standards and align with developing technologies such as rapid test kits, automated colony counting and PCR. Technical resources assist with solving day-to-day problems.

RESULTS Count!

The analyses performed in your lab every day rely on one thing...a **result**. Whether you are concerned with complex research, the rigorous demands of quality control or regulatory compliance, you rely on results to make decisions, execute your next move and take you to the next step of a project. At Fisher Scientific, we recognize the importance of data quality and are committed to helping you achieve accurate, reproducible, reliable results every time!

The Fisher Scientific Advantage

Fisher Scientific believes in partnering with our customers to streamline expenses and total cost of ownership to deliver long-term, sustainable savings. When you partner with us, you receive the benefits of our extensive experience, global reach, depth of product knowledge and proven reliability. We offer the following:

- Unparalleled access to the brands and technical innovation you need today
- Convenient, one-source access to 800,000 products, letting you focus on your work, not paperwork
- Cost-optimization strategies including low-cost alternatives, vendor consolidation and on-site inventory management
- Ability to support your business globally with local sales coverage
- Sourcing power to offer economic value, quality and consistency
- Customized solutions to meet your specific requirements
- A Web site, www.fishersci.com, where you'll find more products, selection tools, technical resources and ordering options as well as methods to track and control funding.

Experience the Difference with Fisher Scientific Lab Essentials

When making buying decisions, look for the Fisherbrand name—your assurance of quality, reliability and value. Our wide selection of products is in stock and readily available, making it easy for you to purchase the right product every time. Our lab equipment—Fisher Scientific accuMET, Isotemp, MicroMaster, PowerGen, SteroMaster and FisherBiotech—is designed with quality and performance in mind. Fisher Chemical and Fisher BioReagents provide access to thousands of high-purity reagents and fine chemicals for research and testing.

We stand behind the Fisherbrand name as we proudly extend to you the Fisherbrand Promise: If our product does not perform to published specifications, we will replace it—no questions asked.

Services and Programs

Today, reaching maximum productivity means working with partners who can help you achieve process efficiencies and leverage external resources.

Fisher Scientific **Managed Services** help customers streamline their business process, reduce costs and increase productivity of their researchers. Our clear understanding of laboratory needs and supply chain processes enable us to create an extensive library of best practice solutions. From these best practices, we offer a complete customizable portfolio of managed services that allows our customer to outsource many of the tasks that distract them from their core business. Services include the following:

- **Lab Supply Management:** Solutions related to the procurement, movement and inventory supplies
- **Chemical Management:** Monitoring of your chemicals from purchase order through disposal, ensuring adherence to lab and regulatory requirements
- **Support Services:** A wide range of products, programs and services that your unique requirements demand; for example, glassware washing and management
- **Professional Services:** A full range of consulting, assessment and implementation services

Have you built a new lab? Moved to a new facility? Received your first grant? Our **New Lab Start-up Program** will take you from empty shelves to a fully functioning lab without the hassle or worry often associated with getting a lab up and running.

Our Supplier Diversity Program provides access to supplier diversity relationships via a Tier 2 business and/or through a Tier 1 access to our supplier partnerships.

Think Green!

Fisher Scientific believes that careful stewardship of the earth and its resources is a responsibility we all share. We proudly support sustainable green initiatives and look for novel ways to continually improve our business processes, as well as those of our customers, to protect the environment. Our initiatives include the creation of decision support tools such as the carbon calculator, the Environmentally Friendly product guide and identification of green products on our Web site to facilitate product selection. Visit www.fishersci.com for resources and tools to support your initiatives and purchasing requirements.

Fisher Scientific is the **one source** that combines the right products, services and experience into **infinite solutions** that drive results...and your success!

All trade names owned by Fisher Scientific.

Chew on this

Results Count

You can count on Fisher Scientific for products that deliver accurate, reliable results every time.

- QA/QC testing
- Food chemistry and biotechnology
- Sample preparation
- Microbiology
- Chromatography systems and supplies
- Water quality testing
- Laboratory services

Visit www.fishersci.com/food for the full line of products or to order the **Food Diagnostics and Testing** catalog.



Fisher Scientific

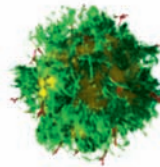
Part of Thermo Fisher Scientific

Phone: 1-800-766-7000 | Fax: 1-800-926-1166 | fishersci.com

ONE SOURCE. INFINITE SOLUTIONS.®

ask big questions

Bold progress occurs when analytical technologies and lab products keep pace with the big questions that come up every day. In the lab, every new answer leads to another question. Questions we help scientists and engineers tackle. From mass specs to consumables to protein reagents, we deliver the innovative instruments and equipment to help optimize application and industry solutions. Driving bold progress through routine days and eureka discoveries. Question after question. Go ahead. Ask.



Thermo
SCIENTIFIC

• see the full breadth of bold progress at thermoscientific.com

