SCIEX

Food testing compendium

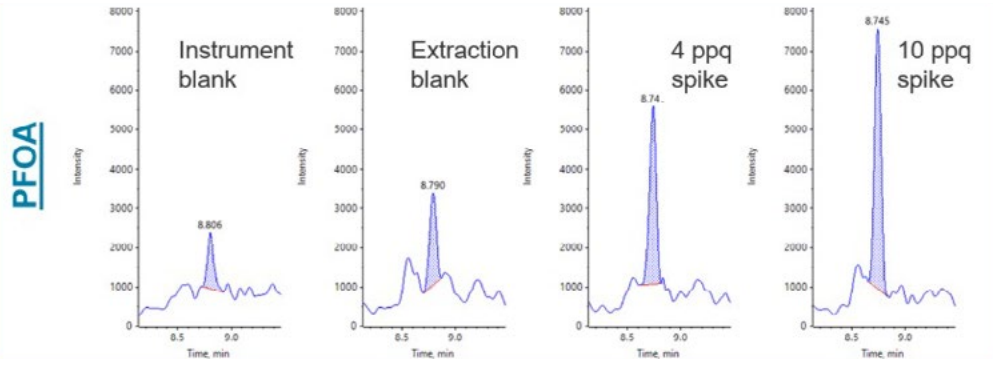
danaher

Contents

Introduction

By Gitte Barknowitz,
Global Market Development Manager,
Food and Environmental Testing

Food has a profound effect on our health, development, and overall wellbeing as well as on that of generations to come. A realistic healthy diet nowadays is nutritious and low in potentially harmful chemicals that can enter the food chain in various stages of production like farming, preserving, and packaging. With a growing global population, we face pressure on food supply chains and the need for automation and processing in food production. Food producers make use of potentially harmful crop-, and livestock-protection chemicals to enhance efficiency. Preservation with food additives and packaging can add further harmful substances to our diet. Laboratory food testing ensures our diets meet the standards governments have set. Food testing laboratories rely on high performance technology to meet requirements for low level detection of residues like pesticides, natural toxins, or veterinary drugs to keep food safe. Scientists conducting these analyses need robust technology, but they also need software that can adhere to the growing challenges of a modern laboratory as well as best-in-class service and application support to keep their laboratory running efficiently.



Eurofins collaborated with SCIEX to deliver 4ppq detection levels of PFOA on the 7500 system

Go to Eurofins webpage →

Go to technical note →

SCIEX map

Food testing requirements vary from country to country, one region may be seeing a surge in analysis in emerging testing areas such as cannabis in North America or the analysis of food product for allergens in Japan. Here we present a global perspective looking at regional food testing trends from our experts.

Karl Oetjen
Market Development Manager, Americas

Jianru Stahl-Zeng
Senior Technical Marketing Manager, EMEAI

Kai Uchiumi
Market Development Manager, Japan

Haiyan Cheng
Market Development Manager, China

See-Chung Yip
Manager, Field Applications and Market Development (FAS/MD), Customer Support

Charlie Liu
Applications Specialist and Market Development, Australia and New Zealand

Never miss a thing

Global trends in food analysis

Global trends in food analysis

Australia and New Zealand

By Charlie Liu,
Applications Specialist and Market Development,Australia and New Zealand

Across both Australia and New Zealand, there is expanding awareness of and desire for high-quality foods and foodstuffs that cater to specific diets, such as gluten-free products. Given the risks involved for consumers with dietary needs, accurate quantitation of potential food contaminants and other allergens is critical. Local demand for the high-quality products that Australia and New Zealand are known for exporting is also on the rise. This has led to increased interest in understanding the potential for contact contamination from food packaging and an uptick in inquiries about testing packaging in addition to food products.

SCIEX is helping to deliver methodologies that meet the food-safety needs of consumers and scientists in this region while providing the high-performance, robust instrumentation our customers have come to expect. The QTRAP and SCIEX Triple Quad systems, and the SCIEX Triple Quad 6500+ system in particular, are popular with food-testing scientists, and the ZenoTOF 7600 system brings non-targeted analysis and industry-leading sensitivity in accurate mass instrumentation that can

help any food-testing laboratory. The ZenoTOF 7600 system can also be useful in the global effort to meet net-zero commitments to cut greenhouse gas emissions. Many novel food development companies have made reducing the impact of animal agriculture on the planet, without compromising on nutrition and flavor, a central focus. The ZenoTOF 7600 system has demonstrated robust proteomic analysis and post-translational modification (PTM) characterization capabilities that can help with product development in support of achieving this goal.

Global trends in food analysis

Taiwan

Steven Liao's
Application Support and Market Development Specialist, SCIEX

The primary purpose of routine food safety testing is to protect consumers. In recent years, mass spectrometry has become widely adopted in the field of food testing, providing both quantitative and qualitative methods for contaminant detection. Mass spectrometry can screen over hundreds of the most common contaminants, including pesticides, veterinary drugs, mycotoxins, and other types of residues, in a single sample analysis run. This not only ensures the safety of the consumed food but also stabilizes trade between regions, reducing unnecessary trade disputes. In addition to the food product, food scientists are also focusing on new types of contaminants that may exist in food packaging, such as PFAS (per- and polyfluoroalkyl substances) and PAAs(Primary Aromatic Amine) etc.

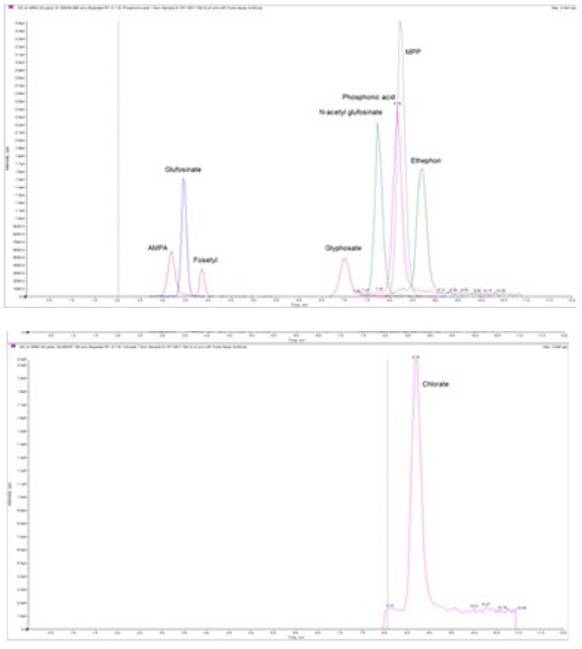
To meet the needs of consumers and scientists in various regions, SCIEX is actively developing methods that can address the specific requirements of different industries. At the same time, SCIEX provides high-performance, robust instrumentation that customers expect. QTRAP and Triple Quad systems are highly popular in the field of food testing. There is also a growing demand for high-resolution systems, that bring non-targeted analysis techniques into routine food testing laboratories. Particularly, the unique EAD analysis technology in the new ZenoTOF 7600 system has elevated analytical techniques to new levels.

Global trends in food analysis

Europe

By Jianru Stahl-Zeng,
Senior Technical Marketing Manager, EMEAI

Throughout the EMEAI region, food-safety testing is driven by regulations. While these regulations are often those defined by the European Commission, many countries outside of the EU set their own or follow the rules of other regulatory bodies, especially if they are exporting produce to the countries in which those regulations apply. Food-safety legislation is under constant review, and although maximum residue limits (MRLs) for contaminants are not regularly changed, the scope of products and analytes to which they apply is often extended. Currently, pesticide regulations specific to baby foods are undergoing significant modifications, from applying to a small subset of pesticides to encompassing all regulated compounds at low concentrations, which can pose challenges for testing laboratories. For example, polar pesticides are a major area of concern but are difficult to quantify due to their properties and related matrix effects. To detect these pesticides at the required low concentrations, laboratories need a way to perform robust, high-throughput analysis of complex matrices with minimal sample preparation.



Direct analysis of polar pesticides in food and environmental samples

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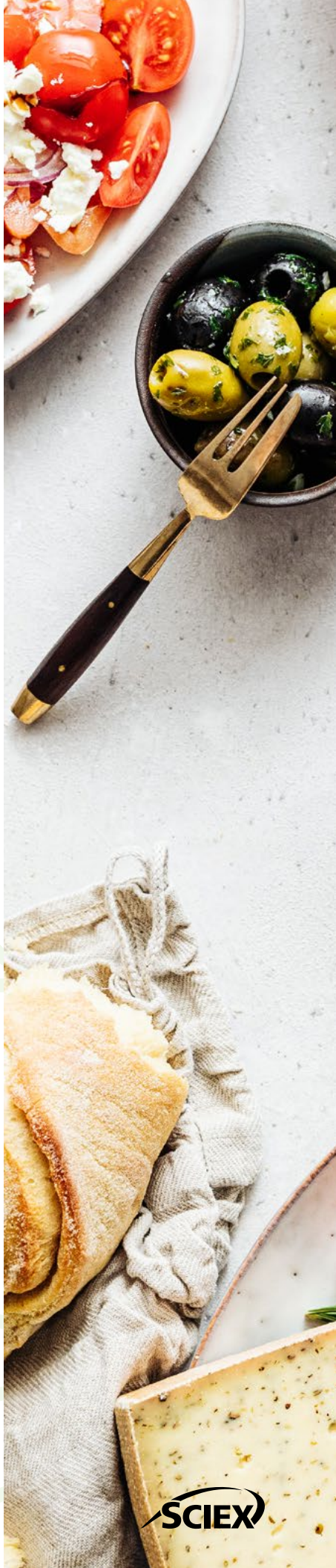
Global trends in food analysis

Europe

Another prominent area of concern is per- and polyfluoroalkyl substances (PFAS). While water and environmental researchers in Europe have monitored and analyzed PFAS for many years, the recent high level of worldwide focus on these chemicals and the growing understanding of their potential harmful effects have driven serious reconsideration of how they are regulated in food and consumer products. Several countries have proposed a total ban on PFAS, and many laboratories are looking to start testing for PFAS in food or expand their testing coverage in anticipation of strict regulations in the future. Again, challenging matrices combined with low required limits of quantitation (LOQs) are driving the need for ever higher-performing analytical instrumentation and methods.

Food legislation is also becoming a high priority for governments throughout the Middle East and Africa that are eager to ensure the health and safety of their citizens, leading to a rise in the need to detect traditional pesticides, mycotoxins and veterinary drug residues, along with newer compounds of concern such as alkaloids and allergens. Where high sample volumes are not required, sample preparation can be more efficient in achieving results using less advanced, routine instruments. However, to ensure laboratories in these regions can quickly and confidently meet demand, robust LC-MS/MS technologies and associated support from SCIEX, including verified methods with predefined SOPs, are essential.

India is another region where food legislation is important. While we see the same demands for food-safety testing in India that we see in the rest of the region, food authenticity has become an additional focus here. The enhanced capabilities of accurate mass and QTRAP systems can play a critical role in meeting various testing needs—such as ensuring high-value commodities like basmati rice are authentic and that honey is not adulterated with corn syrup—and making these analyses routine.



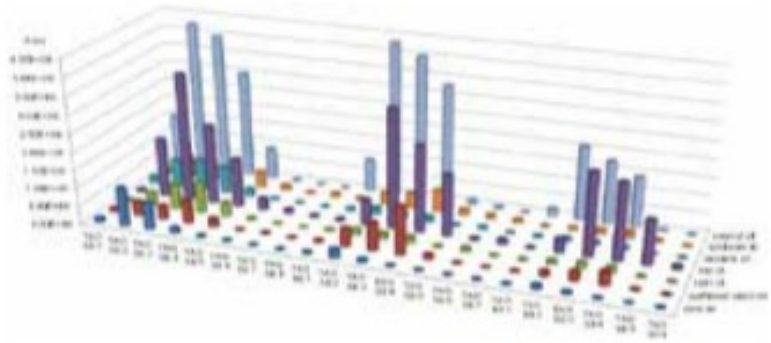
Global trends in food analysis

China

Haiyan Cheng,
Market Development Manager, China

Food testing and food research are the two major applications in the field of food safety in China, and mass spectrometry has a significant role to play in these areas—from safety to health, from farm to fork, from testing to research and from standards to solutions

In the field of food testing, the market in China is segmented according to national or industry standards. Monitoring and risk assessment focus on pesticide residues, veterinary drugs, food packaging, toxins and other contaminants. To help with these tasks, SCIEX collaborates with key thought leaders to develop standard methods for the simultaneous detection of multiple residues and challenging compounds. In addition, SCIEX provides overall solutions for meeting relevant national food standards and an industry application series to streamline residue testing, reduce costs, increase productivity and elevate food testing in China.



Discover how China is employing a holistic approach, 'Foodomics', for their food analysis

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The field of food research in China is focused on food nutrition and food metabolomics. Customers are paying increasing attention to traceability, fraud, identification of nutritional components and building nutritional databases. SCIEX is meeting these customer needs with established food metabolomics workflows, targeted nutritional databases and efficient data-processing methods in multiple metabolomics fields, such as lipidomics and proteomics. SCIEX also contributes to the field of food research by collaborating with customers to publish high-impact articles on topics such as specialty foods, 360-degree lipid analysis and targeted identification of comprehensive nutritional compounds. **Translation on next page 14 >**

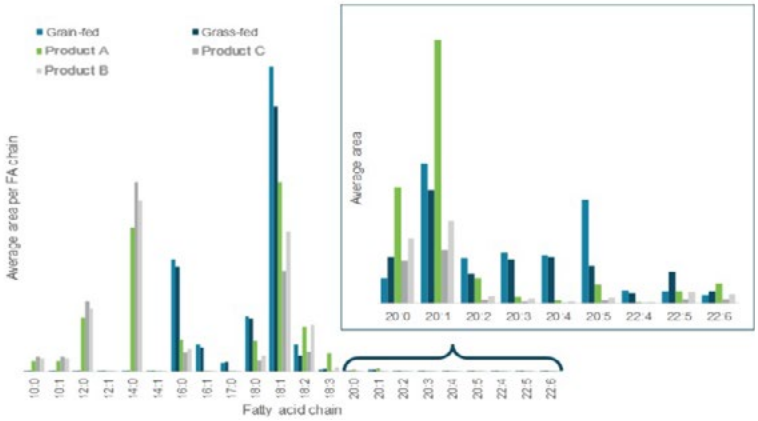
Global trends in food analysis

Japan

Kai Uchiumi,
Market Development Manager, Japan

Globalization has had a significant impact on food safety. International cooperation is essential to the import and export of food, and equally important is understanding and adhering to food safety regulations and recommendations that can vary across the globe.

One example of how regulatory approaches can differ is Japan. While the Japanese market is not large, it is unique. For instance, the QuEChERS method that is widely used around the world is not a national regulatory method in Japan—instead, this method is used in self-inspections. In addition, an accreditation system for testing laboratories already existed in Japan before the establishment of ISO/IEC 17025, so Japan has both the global laboratory accreditation and a national accreditation system in place. Private companies are also making efforts to comply with international regulations for compounds that have no domestic regulations. In recent years, the safety of novel foods—such as cultured meat, alternative proteins and insect-based food—and the detection of functional food ingredients have become hot topics, and Japan might take a unique approach to regulations in these areas in the future as well.



Japan is a leader in novel food and alternative protein. Discover how lipids can help in analysis of alternatively sourced meat

Go to technical note →

SCIEX offers support in all these areas. The robust triple quadrupole and QTRAP systems from SCIEX are useful for meeting the diverse demands of food safety, QTOF systems from SCIEX can help discover and identify functional ingredients and SCIEX OS software helps simplify data analysis and regulatory compliance.

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Global trends in food analysis

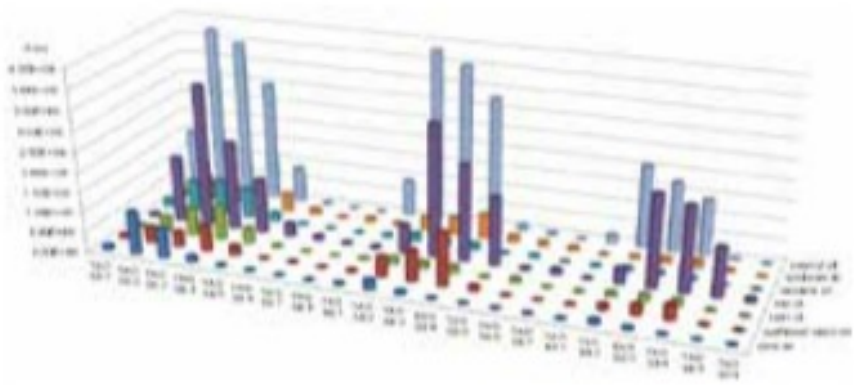
China

Haiyan Cheng,
Market Development Manager, China

食品检测和食品科研是中国食品领域的两大应用方向，聚焦检测，聚力科研，是中国本土市场的市场策略，从安全到健康，从农田到餐桌，从检测到科研，从标准到方案，让质谱改变每个人的生活。

在食品检测领域，细分检测市场，遵循细分行业的国标或者行业标准，进行农残、兽药、食品包材、毒素以及其它污染物的监测和风险评估。SCIEX致力于与重点客户合作开发标准方法，重点在多种物质同时检测以及疑难化合物的标准建立。除此之外，开发相关食品标准的整体解决方案，并形成行业应用文集，助力客户解决疑难物质检测，降本增效。

食品营养和食品组学是食品科研领域的研究重点，从安全到健康，客户越来越关注于食品溯源、食品打假、食品营养成分的鉴定、营养数据库的构建等，SCIEX在代谢组学、脂质组学、蛋白组学等多组学领域建立食品组学工作流程，靶向数据库的构建，以及高效数据处理方法。已与客户合作发表多篇高影响因子的文章，在特殊食品、360度脂类分析、拟靶向全方位营养物质鉴定等前沿领域，助力食品科研。在中国，为中国，服务本土客户，创升中国。



Discover how China is employing a holistic approach, 'Foodomics', for their food analysis

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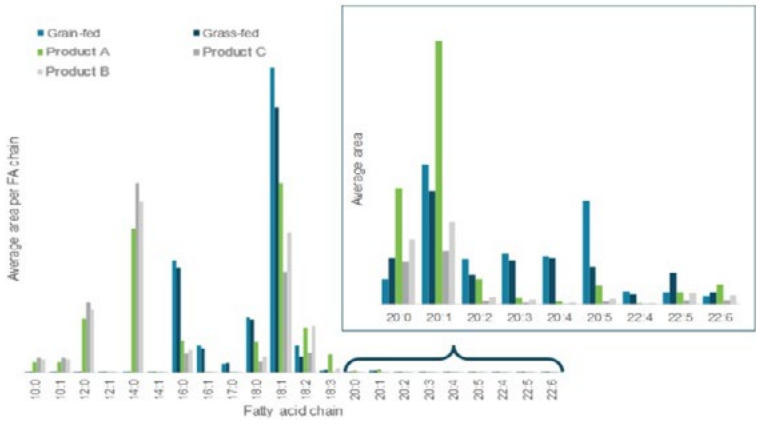
Global trends in food analysis

Japan

Kai Uchiumi,
Market Development Manager, Japan

グローバリゼーションは食の安全にも影響をもたらしています。食品の輸出入を考えた場合、国際社会との協調は不可欠であり、当然日本の規制にもその影響はあります。しかし、日本の市場は比較的小さい割にはユニークです。例えば、現在世界中で広く採用されているQuEChERS法は、日本国内の規制法では採用されていませんが、自主検査では使用されています。ISO/IEC 17025よりも以前から、独自の分析機関の認定制度が存在することから、この試験所認定と国内の認定制度の両方が存在する形になっています。また、国内に基準規制がない化合物では、国際的な規制に対応すべく企業努力がおこなわれているケースもあります。さらに、近年、培養肉、代替タンパク質、昆虫食などの新規食品が話題となっていますが、ここでも今後日本はユニークな方向へ進むかもしれません。また、食の安全だけではなく、食品の機能性成分も日本では関心を集めていいます。

食の安全についてはその多様な要求にSCIEXの頑健で高感度なTriple Quadあるいは QTRAP®が、機能性成分などの側面ではQTOFがその発見や同定に役立つでしょう。そしてSCIEX OSはデータ解析の簡略化や法規制の遵守に役立つでしょう。



Japan is a leader in novel food and alternative protein. Discover how lipids can help in analysis of alternatively sourced meat

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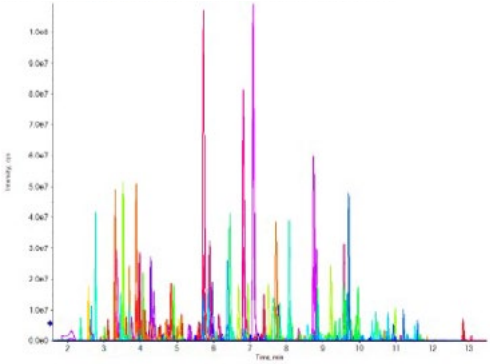
Global trends in food analysis

Americas

Karl Oetjen,
Market Development Manager, AMER

The infrastructure for food-safety testing in the Americas is built on the quantitation of a variety of chemical classes, with pesticides, veterinary drugs and mycotoxins as the major analytes of interest. In recent years, the scope of testing has expanded to include per- and polyfluoroalkyl substances (PFAS), food authenticity, allergens and process impurities such as acrylamide. Ingredient analysis is also a focus, as manufacturers of food products and dietary supplements, for example, need to verify the concentrations of key nutritional components and active ingredients in addition to meeting regulatory requirements for chemical contaminants.

As the maximum permissible concentrations of residual contaminants (typically in the low parts-per-billion range, but can reach the parts-per-trillion level) and the quantitation requirements for food ingredients continue to evolve, laboratories must be able to reliably quantify these disparate analyte classes—day-to-day, month-to-month and year-to-year. In addition, continued pressure for analytical efficiency has scientists seeking complete workflow solutions that can minimize per-sample turnaround time and cost, often by expanding the panel of analytes they can cover in a single analysis. To meet these demands, many laboratories have turned to liquid chromatography coupled with mass spectrometry, which offers the sensitivity, selectivity, throughput and robustness they need to be successful.



Everything from mycotoxins, pesticides, to veterinary drugs can be detected and analysed in a single run

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At SCIEX, we are committed to working with the food-testing community to support its critical role in consumer safety. We realize this commitment through customer consultations that inform how we bring our next-generation food workflows to market. The results of this commitment can be seen in the throughput and uptime made possible by the sensitivity of the SCIEX 7500 system, the confidence in unknown identification enabled by using the ZenoTOF 7600 system and the processing efficiencies that come from utilizing SCIEX OS software.

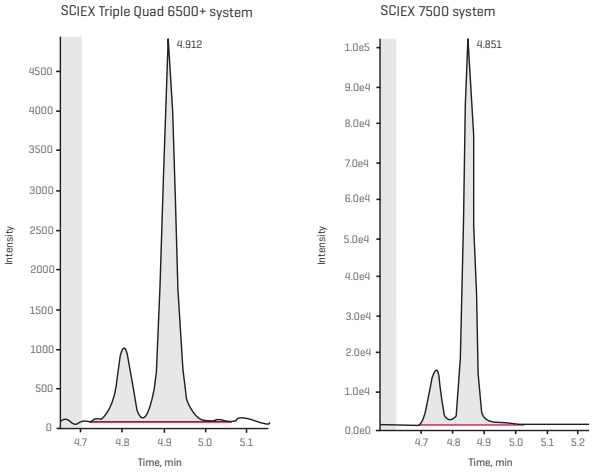
Global trends in food analysis

Southeast Asia

By See-Chung Yip,
Manager, Field Applications and Market Development (FAS/MD), Customer Support

As of June 2022, Singapore is the first and only country in the world to have approved cultivated meat for sale. This approval is based on guidance published (initially in 2019) by the Singapore Food Agency (SFA) that details the requirements for the safety assessment of novel foods, including specific requirements for the information that must be submitted for approval of cultivated meat and fermentation-enabled products.

In recent years, many new novel food manufacturers have emerged in the Southeast Asia market. Leading mass spectrometry solutions from SCIEX can help regulatory labs, research labs and novel food manufacturers adhere to regulations related to novel foods, such as the SFA guidance, by enabling testing for allergens, cell culture media and nutrition.



The SCIEX 7500 system data (right) shows a 7.1x increase in S/N compared with the SCIEX Triple Quad 6500+ system data (left), for per-fluorohexanesulfonic acid (PFHxS)

Go to technical note →

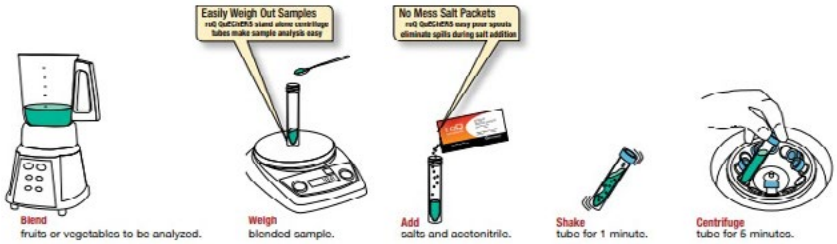
While per- and polyfluoroalkyl substances (PFAS) have been manufactured for over 80 years, their effects on human and environmental health were poorly understood for a long time. In September 2020, the European Food Safety Authority (EFSA) published a new health risk assessment related to PFAS in food, and in October 2022, the first annual AOAC Southeast Asia Section Meeting took place with a notable emphasis on testing for PFAS in food. Since then, regulatory laboratories across the Southeast Asia region have taken a keen interest in PFAS testing, and they are turning to SCIEX for its expertise in this area.

Consumables for food testing

Richard Jack,
Market Development Manager, Phenomenex

Food is a lifeline of our society. At Phenomenex, a primary focus is supporting our local and global food safety and quality organizations with tools and resources to help ensure that food is safe and food labels are accurate. Phenomenex is committed to supporting industry needs through a comprehensive product portfolio of sample preparation products, HPLC/UHPLC columns, LC-MS columns and GC-MS columns and accessories, along with application and method development services for meeting food industry guidelines.

The full portfolio of sample preparation products and filters provided by Phenomenex—including roQ QuEChERS, Strata SPE and Phenex and Claricep filters for extraction and removal of particulates to sub-micron levels—play a critical role in preventing the injection of any drug, or dirty sample into an HPLC, GC or mass spectrometer. This helps ensure low-level detection and keeps columns and systems up and running to maintain robust analysis capabilities.



Discover the various sample preparation options from Phenomenex

Our wide variety of column technologies provide coverage for a full range of particle sizes—from core shell to microporous particles—for complementary and orthogonal selectivity. For example, with our Kinetex EVO C18 columns, you can achieve lower back pressure and similar or better performance with three options: keep the lower pressure for less system strain, increase the flow for higher productivity or utilize a longer column length to increase potential resolving power. Our Luna column is a leading reversed-phase column because it provides measurable improvement over many HPLC columns for two important chromatographic properties: resolution and peak shape. The high efficiencies and bonded-phase surface coverage provide for sharp peaks.

With over 30 years of experience with developing products in collaboration with food manufacturers and global regulatory bodies and tailoring solutions to emerging MS technologies, from MS/MS to HRMS, at Phenomenex we know that success in food safety relies on working together as partners.

Our internal experts

Craig Butt,
Applied Markets Manager,
Global Technical Marketing

The Future of Food Analysis. Expanding analyte list demands.

In the next several years, analyte panels for food testing will continue growing, putting pressure on both the instrumentation as well as analytical chemists to adapt. For example, the evolution of the pesticide industry may introduce new compound classes or chemistries not previously seen. Alternatively, chemicals that were previously thought of being "safe" may come under new regulatory spotlight. Efficiency and productivity targets will drive the desire to analyze these new chemicals within existing methods, ultimately building towards so-called "mega" methods. Sample preparation methods must be universal to ensure good analyte coverage while minimizing matrix effects and maintaining data quality. Further, LC and mass spectrometry methods will need to adapt to the increased analyte demands.

How can mass spectrometry help? Improved instrument sensitivity inherently allows for lower detection limits. In addition, greater instrument sensitivity allows for more innovative solutions to our customer's problems. For example, the ability to dilute out matrix interferences to improve data quality or to simplify sample preparation methods for greater analyte coverage. Non-target analysis expands analyte coverage, improves confidence.

The upcoming years will also witness the continued adoption of accurate mass spectrometry workflows for routine food analysis. Non-target acquisition workflows provide additional lines of evidence – and therefore greater confidence – for the detection and identification of food contaminants. These include precursor and fragment mass accuracy, as well as MS/MS library matching. High-end QTOF instruments are sensitive enough to allow for routine food testing. In addition, the greater specificity helps to resolve complex matrix interferences, leading to greater data quality. Further, accurate mass workflows can be used to evaluate food authenticity such as honey and spices.

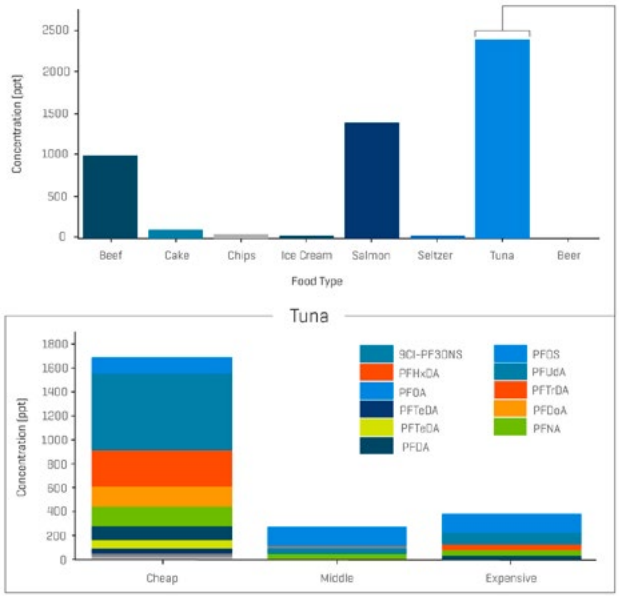
Watch fireside chat videos →

Our internal experts

Holly Lee,
Food LC-MS Scientist, Global Technical Marketing

"Food is essential to life, so make it good."

As a food LC-MS scientist, my definition of "good" is layered, and it extends beyond typical sensory characteristics—such as appearance, aroma, taste and texture—to less perceivable traits, such as nutrition, safety and authenticity. The importance of a sustainable and healthy diet cannot be overstated. We face malnutrition issues and the burden of feeding a global population of 8 billion people and growing amidst declining natural and environmental resources. New and alternative methods are being actively researched in the agri-food sector to increase the productivity of urban food production and develop novel foods from alternative protein sources.



Holly shows us how PFAS detection in food matrices is performed

Cellular agriculture, precision fermentation and plant molecular farming all rely on animal-free sources to produce recombinant proteins, which in turn are either used as ingredients themselves or ultimately transformed into meat, seafood or dairy products. Given that the application of these technologies in food production is still largely in the research and development phase, questions concerning the safety and hazard profiles of these novel foods and their production processes must be addressed by regulatory agencies, food safety testing labs and food companies, many of which have turned to mass spectrometry (MS) as a solution.

Our internal experts

Holly Lee continued...

MS is widely regarded as the gold standard for food safety testing to ensure that chemicals such as pesticides, veterinary drugs, natural toxins and additives and preservatives in food and food packaging are compliant with regulatory limits. In addition to testing for these known hazards, the use of MS in foodomics applications is gaining ground. This is especially true for detecting unexpected and potentially deleterious chemicals from adulteration and transformation products derived from the production, storage and processing conditions for both conventional and novel foods. MS-based metabolomics, lipidomics and proteomics will be critical for profiling the differences in nutritional components, additives, contaminants and allergens between conventional and novel foods.

The identification of novel biomarkers to detect new allergens coming from alternative protein sources and to trace the origin of protein sources will help regulators and food producers enhance consumer confidence in the safety and authenticity of novel food products. We must also widen our lens to look beyond North America and Europe as the center of gravity in future food production and look toward the Asia-Pacific region, where Singapore has become the first country to legally approve lab-cultivated chicken meat for consumption.

Detecting food adulterants in China

Jiukai Zhang, Ph.D
Associate Professor of Agro-product Safety Research Center, Chinese Academy of Inspection and Quarantine (CAIQ)

At CAIQ, we focus on food authentication studies, such as species identification, origin traceability, and quality identification, that are based on mass spectrometry. In China, the most common adulteration practice is species substitution, especially in high value-added food and supplements. For example, edible bird's nest - an expensive, traditional Chinese ingredient harvested from swiftlet nests - is commonly substituted with cheaper materials such as egg white. Mixing berry fruit juice with inexpensive substitutes is also a common practice.

"The major challenge in our work is that you never know what will be added next, and targeted analysis of just a few constituents or even a single ingredient is very insufficient for food authenticity."

We have found that authentication technologies are often playing catch-up to adulteration techniques. The major challenge in our work is that you never know what will be added next, and targeted analysis of just a few constituents, or even a single ingredient, is very insufficient for food authenticity. The SCIEX TripleTOF 6600 allows us to carry out high-throughput metabolomics and proteomics studies for food authentication. In addition, the omics analysis software, such as MarkerView software, ProteinPilot software, and UpidView software are used for database searching and data processing. The global food trading market makes the food chain longer than ever before, increasing novel ways of adulteration. With this high-resolution mass spectrometry (HRMS) set-up, we can achieve large-scale analysis of numerous targeted or non-targeted characteristic markers in food samples.

Products

SCIEX OS software

By April Quinn-Paquet,
Global Product Marketing Manager,
SCIEX OS software

Mass spectrometry has become the gold standard solution for quantitative analytical assays in many applications, from food testing to pharmaceutical drug research and development. Software plays a key role in all these applications, because without it, we can't drive the instrument or process the data it generates.

Users want to load their samples and push a button—without the need to monitor the system until data are acquired, processed and ready for review—and during data review, they want to be able to easily identify outliers and failed samples. SCIEX OS software brings this vision to life with an easy-to-use interface and automated batch-building tools. It also provides automated customizable decision rules that immediately determine what to do with a sample that fails acceptance criteria and automated data processing and sample flagging rules.

While Analyst software was the flagship data acquisition and processing software for SCIEX triple quadrupole and QTRAP systems, SCIEX OS software is the platform of the future, bringing all SCIEX mass spectrometers under a single software for acquisition and processing. With advanced tools that streamline and automate workflows like never before, and data security with built-in 21 CFR Part 11 compliance tools, SCIEX OS software can transform the way you work.

The technical debt incurred by not maintaining up-to-date software can be detrimental to the overall efficiency of the lab. With regular cadence updates to SCIEX OS software, driven by the feedback we gain from our users through various channels, we strive to continue to serve our customers in the best way possible.

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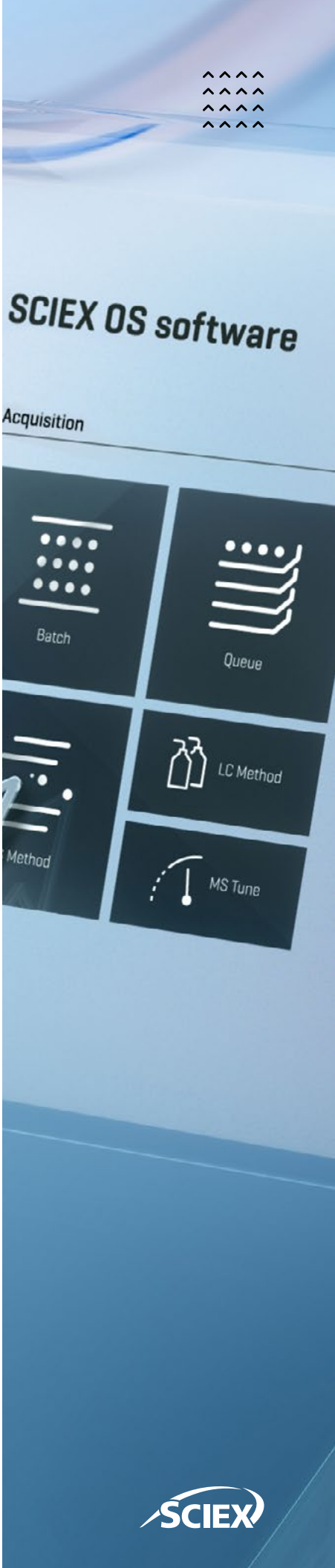

SCIEX OS software

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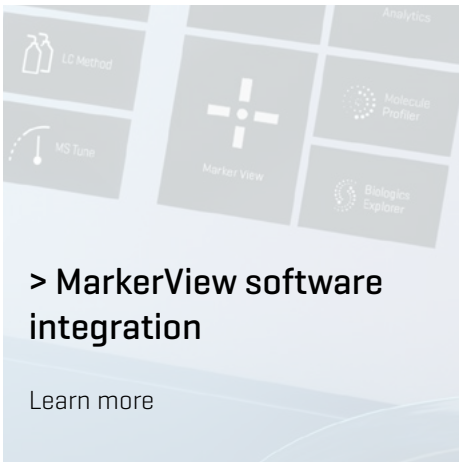
Software to power your SCIEX ecosystem

Engineered to do more. Faster.
The integrated software platform solution for all SCIEX innovations; SCIEX OS software delivers data integrity, seamless usability and efficiency gains for your mass spectrometry workflows throughout your laboratory. Built on advanced and sophisticated algorithms, SCIEX OS software facilitates instrument control and automated data processing, simplifying your workflows and empowering swift, well-informed decision-making.



> MarkerView software integration

Learn more

> Scout triggered MRM (stMRM)

Learn more

> Central Administrator Console

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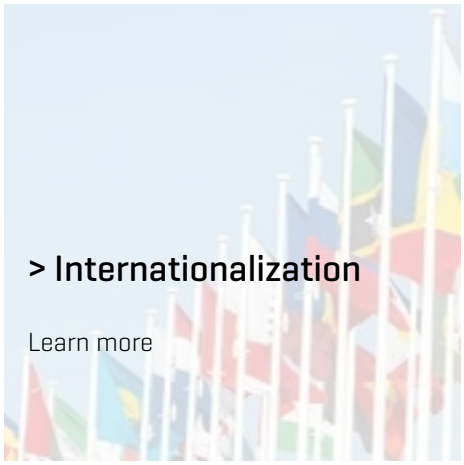


> Internationalization

Learn more

>Zeno SWATH DIA integration

Learn more

SCIEX 7500+ system

Setting a new standard for instrument resilience.

The SCIEX 7500+ system is a triple quadrupole engineered to maintain our highest sensitivity for up to twice as long in complex matrices.

Go to webpage →

> Mass Guard technology

The innovative ion filtering technology that reduces the risk and frequency of instrument contamination, maintaining our highest sensitivity for up to twice as long

> Newly designed removable DJet+

The removable Djet+ assembly allows users to clean and maintain it themselves, making it easier to schedule front-end cleaning.

> Speeds of up to 800 MRM per second

The fastest SCIEX Triple Quad yet increases the capacity for large quantitation panels that incorporate new compounds of concern.

> Ionization Source

The OptiFlow Pro ion source incorporates the reliability and efficiency of the legendary Turbo V ion source while providing flexibility for quickly switching flow rates.

> QTRAP system

Exclusive to SCIEX, QTRAP functionality like product ion scans enable improved confidence, while MRM3 workflows push quantitation levels through matrix interferences.

> Detection

Precise and robust engineering of the ion rail delivers consistent and reproducible analysis time after time, by focusing and transmitting the crucial ions you need for your study.

> Deliver on important timelines

SCIEX OS automated decision making means your system spends more time generating the results you need to hit your project deadlines.

> More energy efficient

The 7500+ system is compatible with dry roughing pumps, which can reduce electricity consumption by up to 24% relative to oil-sealed pumps.

Watch product video >

SCIEX 7500 system

Go to webpage →

> D Jet ion guide

Capture more of the ESI plume and retain more important ions. The D Jet ion guide concentrates samples and removes gas molecules and neutral ions.

> QTRAP system

Gain additional QTRAP functionality. Pairing conventional MRM workflows and Enhanced product ion scans enable improved confidence in acquired data. MRM3 workflows push quantification levels through matrix interferences.

> Ionization source

Execute fast interchanges between high flow and low flow to adapt to your workflow needs. The OptiFlow Pro ion source introduces a new modularity feature and incorporates the reliability and efficiency of the legendary Turbo V ion source.

> E Lens probe

Get a stronger gradient around the orifice and protect your precious sample. With E Lens Technology, the SCIEX Turbo V Ion Source geometry is enhanced in the new OptiFlow Pro Source, which focuses transmission of the ESI plume into the orifice of the system.

> Detection

Attain lower levels of quantification. The precise and robust engineering of the ion rail allows consistent and reproducible analysis time after time, by focusing the crucial ions you need for your workflow

Watch product video >

Precise testing of pesticides in food using the SCIEX Triple Quad™ 7500 LC-MS/MS System – QTRAP® Ready

Highly sensitive analysis of multi-compound panels in various matrices for food regulations

Jianru Stahl-Zeng1, Ian Moore2, Thomas Biesenthal2, Jack Steed3, Wim Broer4 1SCIEX, Germany; 2SCIEX, Canada;
3 SCIEX, UK, 4Nofagroup, The Netherlands

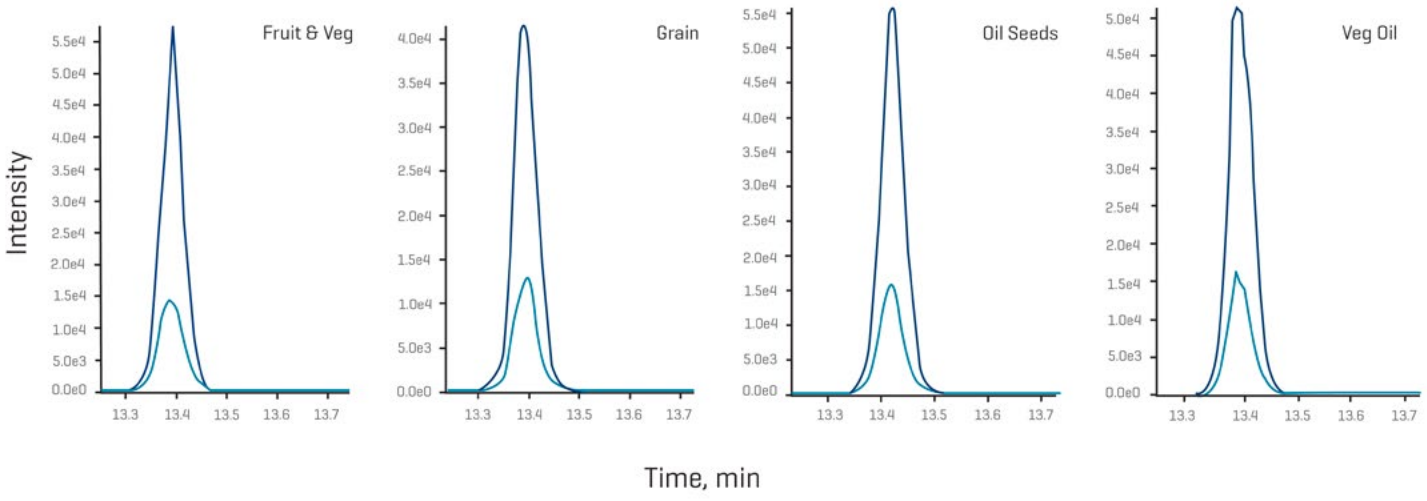
Abstract

The SCIEX Triple Quad 7500 LC-MS/MS System - QTRAP Ready provides impressive levels of sensitivity, robustness and accuracy for trace level analysis of pesticide residues in food matrices. Here, over 1400 MRM transitions for 700 compounds were analyzed in a single analysis achieving quantification limits of 0.2 ng/mL for the majority of the pesticides tested.

Introduction

The intensive use of pesticides in agriculture has led to the need for rigorous and extensive use of analytical technologies to ensure that there is no impact on human populations. Depending on the class of compounds, this has been primarily achieved through LC-MS/MS. Maximum residue limits (MRL) are set for regulated residues that define the highest level of a pesticide residue that is legally tolerated in food such that it is safe for consumers. Often these MRLs are set very low for some pesticides, to ensure highest safety, requiring very sensitive instrumentation to accurately quantify these compounds down to their MRL. Therefore LC-MS/MS solutions must be robust and sensitive to meet the needs of food testing labs.

In this method, over 700 compounds have been analyzed, covering required testing for numerous regions including Europe, North America and various areas within Asia. This breadth of coverage of pesticides has been achieved in part due to the increased sensitivity observed when utilizing the SCIEX Triple Quad 7500 LC-MS/MS System – QTRAP Ready relative to previous generation instruments.[1] Improvements in both the generation of ions and the sampling of ions has resulted in significant sensitivity gains.[2] For residue testing in food testing, this means that more analytes can be combined into a single analysis, complex matrices can be further diluted to reduce matrix effects, while still being able to achieve or exceed the necessary levels of sensitivity.



Go to full technical note →

Determination of pyrethroids and macrocyclic lactone insecticides in spices and tea

Using the SCIEX 7500 System

Cathy Lane,1 Sara Cheikh Ibrahim,2 Tino Schroeder,2 Susanne Hergett,2 Jack Steed,1 Jianru Stahl-Zeng,3 Roy Sperling2
1SCIEX, UK; 2Bilacon, Germany; 3SCIEX, Germany

Abstract
Pyrethroids and macrocyclic lactones are insecticides widely used in the agriculture/horticulture industries and have been designed based on the naturally occurring family of pyrethrins. To monitor the levels of these insecticides in final food products, an robust and sensitive method is required. Here an assay has been optimized for the SCIEX Triple Quad 7500 system using a total run time of 17 mins, monitoring eleven different compounds. Excellent sensitivity in solvent was been demonstrated with LLOQ values down to 0.02 ng/mL. Detection levels of 5-10 ppb for most insecticides were also demonstrated in tea and spice.

Introduction
Pyrethroids and macrocyclic lactones are groups of commonly used insecticides in the agriculture and horticulture industries. Macrocyclic lactones are naturally occurring, or semisynthetic, compounds produced as fermentation products in soil-dwelling Streptomyces avermitilis.[1] Pyrethroids, on the other hand, are synthetic, and were designed based on the naturally occurring family of pyrethrins, which were originally derived from chrysanthemum flowers.[2]

Due to the widespread use of these compounds in the environment, a comprehensive quantitative method is necessary to monitor and control their concentration in final food products destined for human consumption.

Here, a method has been developed using the SCIEX 7500 system for the simultaneous identification and quantification of pyrethroid and macrocyclic lactone insecticides at detection levels below the maximum residue level defined by the European Commission under regulation 2018/1514.3

Key features of the SCIEX 7500 system for the quantification of pesticides in spices and green tea:
> Highly sensitive detection and quantification of avermectin (containing 96% avermectin B1a and 4% avermectin B1b), bifenthrin, cyfluthrin, cypermethrin, deltamethrin, fenvalerat, λ -cyhalothrin, milbemectin A3 and A4 and permethrin from QuEChERS extracts of spices and green tea
> Improved sensitivity over previous assays with lower limits of quantification (LLOQs) down to 0.02 ng/mL in solvent (Figure 1)
> Optimization of new parameter QOD for milbemectin A3 in spices resulted in greatly reduced background and increased signal to noise
> Increased sensitivity allows for the use of lower sample injection volumes, increasing assay robustness and significantly reducing ion suppression in matrix

Go to full technical note →

Measuring PFAS in a variety of food samples at different price points

Karl Oetjen, Simon Roberts, Igor Zakharevich

SCIEX, USA

Abstract

Recent studies have shown that per- and polyfluoroalkyl substances (PFAS) accumulate in the food chain and are found in a wide variety of food products, including fish, meat, dairy and vegetables.[1] As a result, there is a growing concern about the potential health risks associated with consuming PFAS-contaminated foods. As the public becomes more aware of these compounds, they might make purchases that they believe would decrease the amount of potential exposure to PFAS. Many people may assume that more expensive alternatives might represent a healthier or less PFAS-contaminated option.

Introduction

This study explored the differences in PFAS concentrations in several food types at different price points. Eight different food products were selected to represent a wide range of food types, including ground beef, cake, salmon, tuna, potato chips, seltzer, beer and ice cream. For each type of food, low-, mid- and high-priced options were purchased for analysis. The samples were analyzed using the SCIEX 7500 system using a large volume injection, PFAS compounds were detected in food in the low parts per trillion (ppt) or picogram per gram (pg/g) depending on the analyte.

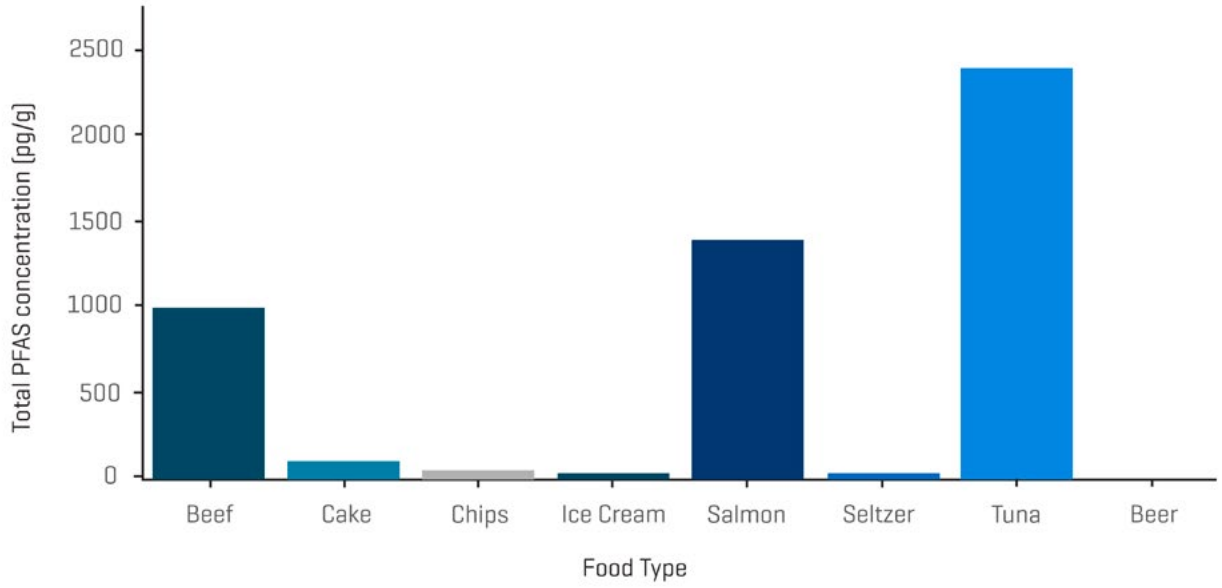


Figure 1. The foods sampled for this study ranged from solid, protein-rich foods, like fish and ground beef to liquid beverages like beer and seltzer and highly processed foods like chips and cake. The study sought to determine PFAS levels across very different matrices and whether price plays a factor in the distribution.

Go to full technical note →

Achieving exceptional robustness for PFAS analysis in food with the next-generation SCIEX 7500+ system

Holly Lee, Ian Moore, Craig M. Butt and Elliott Jones

SCIEX, USA

Abstract

This technical note demonstrates >2x robustness improvement for the analysis of PFAS food extracts on the SCIEX 7500+ system. At the end of the study, comprising over 6400 food matrix injections, the majority of PFAS compounds (10 out 13) maintained >70% of the initial sensitivity. Residue analysis in food matrices is challenged by the presence of interfering co-extractables which can result in instrument contamination and system downtime. Here, the robustness of the SCIEX 7500+ system and SCIEX 7500 system was evaluated in an accelerated manner through an aggressive sample preparation procedure and by omitting the diverter valve. The SCIEX 7500+ system features new Mass Guard technology1 designed to improve instrument robustness while maintaining optimal sensitivity longer.

Introduction

This study explored the differences in PFAS concentrations in several food types at different price points. Eight different food products were selected to represent a wide range of food types, including ground beef, cake, salmon, tuna, potato chips, seltzer, beer and ice cream. For each type of food, low-, mid- and high-priced options were purchased for analysis. The samples were analyzed using the SCIEX 7500 system using a large volume injection, PFAS compounds were detected in food in the low parts per trillion (ppt) or picogram per gram (pg/g) depending on the analyte.

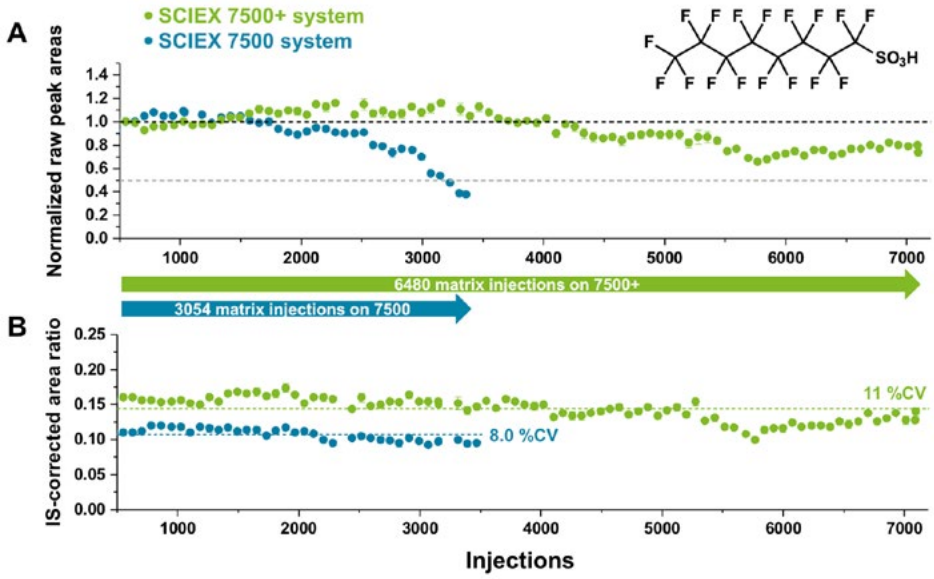


Figure 1. Raw peak areas normalized to initial response (A) and internal standard (IS)-corrected peak area ratios (B) for perfluorooctane sulfonate (PFOS) in solvent quality control (QC) samples on the SCIEX 7500 (blue) and on the SCIEX 7500+ (green) systems

Go to full technical note →

Direct injection analysis of pesticides in fruit juices on a next-generation, highly robust triple quadrupole mass spectrometer

Holly Lee, Michael Deng, Paul R.S. Baker, and Craig M. Butt

SCIEX, Canada; 2 SCIEX, USA

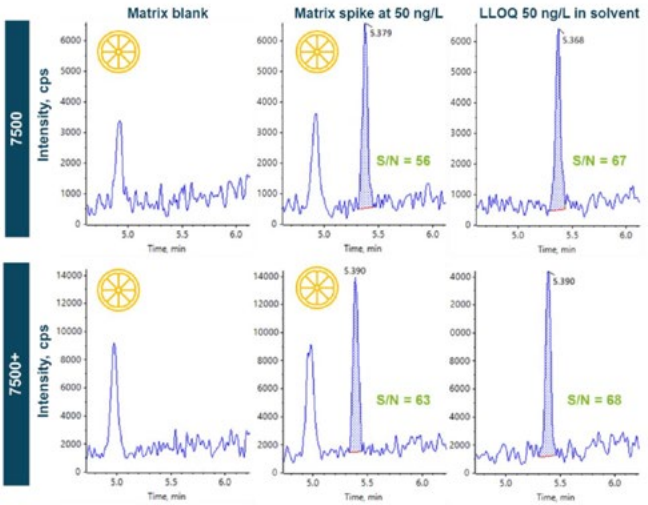
Abstract

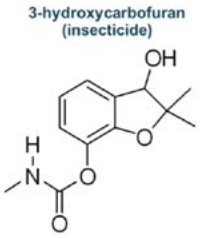
In this technical note, a comparative study was performed to evaluate the sensitivity performance of the SCIEX 7500 system and the SCIEX 7500+ system for the quantitation of pesticides in orange juice. Food and beverage samples are known for their complexity and contributions to matrix effects from co-extractables. Furthermore, these matrices are known to contribute to instrument contamination. The SCIEX 7500+ system with Mass Guard technology1 was designed to address instrument robustness while maintaining the sensitivity of the SCIEX 7500 system. Herein, a quantitative method for analyzing >200 pesticides in orange juice demonstrated method transferability and equivalent sensitivity from the SCIEX 7500 system to the more robust SCIEX 7500+ system (Figure 1).

Introduction

The analysis of pesticides in food and beverage matrices is essential in assuring food safety. The European Commission has imposed maximum residue limits (MRLs) on pesticide residue levels in food and animal feed.2 As such, considerable efforts are directed toward the quantitative analysis of these compounds. High-performance liquid chromatography-mass spectrometry (LC-MS/MS) is a powerful analytical technique used for pesticide residue testing in food due to its high sensitivity and specificity. However, their detection is challenging due to the diverse chemistry and occurrence of pesticides and the complexity of food matrices. Considering that the EU MRLs for many pesticides are in the sub-to-low parts per billion (ppb) range,2 instrument robustness is important for maintaining assay sensitivity and analytical productivity.

The SCIEX 7500+ system features enhanced robustness using Mass Guard technology1 that maintains the high sensitivity of the SCIEX 7500 system while providing dedicated hardware components that decrease instrument contamination and improve customer access to the instrument front-end DJet+ assembly to facilitate instrument cleaning.3 In this technical note, the SCIEX 7500 system and SCIEX 7500+ system demonstrated equivalent sensitivity based on S/N within ±20% of one another and similar LLOQ values in the mid-ppt to high-ppb range for the target panel of pesticides analyzed. In both systems, >90% of the pesticides exhibited LLOQs below the general default MRL of 0.01 mg/kg specified for most pesticides.3





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SCIEX QTRAP 6500+ system

Go to webpage →

Revolutionary sensitivity, speed, and performance with IonDrive technology

The Triple Quad 6500+ system features multi-component IonDrive technology including the IonDrive High Energy Detector+ that pushes the boundaries of LC-MS/MS quantification farther than ever before. The revolutionary sensitivity, speed, and performance delivered through these technology enhancements enable you to see it all, from low mass to high mass compounds, in positive or negative polarity – in a single injection, with high sensitivity, reliability, and confidence.

Enhancements for the 6500+ series

The production of more ions with the IonDrive Turbo V source is just one of the enhancements you will see with the Triple Quad 6500+ system. Also added is the ability to capture and transmit more ions with the unique IonDrive QJet guide and greater detection with the new IonDrive High Energy Detector+.

> IonDrive Turbo ion source

The legendary Turbo V source increases ion production by using enhanced gas flow dynamics and optimized heater configuration to improve reliability, reproducibility, and robustness.

> IonDrive QJet ion guide

With its dual-stage design, the IonDrive QJet ion guide improves sensitivity and ion capture rate while focusing ions more efficiently than funnel approaches.

> IonDrive High Energy Detector+

Pulse counting fundamentals achieve ultra sensitivity at the lower end, while increasing linearity at high count rates. The result is the collection of more ions across a broader dynamic range.

> SelexION+ DMS technology

Ideal development suite for applications requiring the separation of isobaric species, isolation of challenging co-eluting contaminants, and reduction of high background noise.

SCIEX Triple Quad 5500+ system

Go to webpage →

Engineered to deliver best-in-class quantitative analysis

The best just got better. The SCIEX Triple Quad 5500+ system is equipped to conquer your laboratory's most complex workflows and opportunities. With this LC-MS/MS system, you have the sensitivity and performance to meet analytical and regulatory demands for low-level trace detection with ease.

Key workflows

Whether for pharmaceutical analysis or food and environmental testing, the SCIEX Triple Quad 5500+ system delivers the high-quality data you need to make decisions.

> Regulated bioanalysis

The SCIEX 5500+ system delivers quantitative and qualitative results for a broad range of diverse drug products. It achieves impeccable levels of sensitivity and selectivity and helps to ensure proper dosage, efficacy, and safety.

> Water quality testing

Acquire data that meets the low-level trace detection requirements of drinking and wastewater labs. Increase confidence with unrivaled confirmation scans like EPI for spectral library assurance.

> Antibiotics in food

Regulations determine the allowed levels of veterinary drugs in food products. These low-level residues are detected easily with MRM workflows. Activate QTRAP functionality to have even more confidence in your results.

> Toxins in food

This high-throughput workflow for mycotoxin testing is critical to achieving regulatory compliance. Use a combined MRM and QTRAP library workflow to achieve a new level of confidence in your data.

> Pesticides

A variety of complex matrices are involved when testing for pesticides in fruit, vegetables, water, soil and other samples from emerging markets like cannabis. Quantify and confirm large suites of pesticides using these robust workflows.

SCIEX Triple Quad 4500 LC- MS/MS System

Go to webpage →

Consistent, Reliable Quantitation Around the Clock

When your lab is faced with lots of samples and impending deadlines, you can't afford an unreliable mass spec system that could put your lab or your reputation at risk. Some mass spec solutions can crack when faced with pressure:

> Data quality erodes during long runs
> Data processing is time consuming and becomes a bottleneck
> Getting immediate answers to solve problems as they arise is impossible

These challenges can be detrimental to your lab's productivity. The 4500 system is designed to conquer them

See the 4500 system in action for these common workflows

The 4500 system is a great fit for applications requiring round-the-clock quantitation, with the robustness to handle repeated injections of complex samples and reliability to minimize downtime. Here you can explore methods and see how the 4500 system performs in these selected applications.

> Food allergen testing

Undeclared food allergens is one of the primary sources for food recalls today. It's time to reduce the risk. Meet the state-of-the-art allergen screening assay designed to improve throughput, reliability, and confidence in your food allergen screening results.

Learn more >

> Gluten quantitation in foods

Gluten is a multi-protein complex located in the endosperm portion of wheat, rye, and barley grains that are commonly found in Western diets and are steadily becoming more prevalent in Eastern diets

Learn more >

ZenoTOF 7600 system

Go to webpage →

Zeno SWATH Data Independent Acquisition (DIA)

Dive deeper into the biomarker landscape. Zeno SWATH DIA marks a significant step-change in data independent acquisition delivering a high depth of coverage, particularly on low abundance species, quickly and robustly.

The Zeno trap in combination with SWATH Acquisition enables significant sensitivity gains through the use of Zeno trap enabling researchers to routinely quantify up to twice the number of plasma proteins than previously possible.

A step-change in fragmentation technology

EAD allows for a range of free electron based fragmentation mechanisms within one device. The ability to tune electron kinetic energy within an EAD experiment extend the utility of the approach to all molecules type from singly charged small molecules to large multiply charged proteins.

> Low EAD
biomolecule analysis

Protein based therapeutics come with a rich assortment of varying structures. Those modifications exist in complex heterogeneous mixtures.

> Mid EAD
post-translational modifications

The EAD cell brings fresh insight and completes the picture for biomolecule characterization. EAD, fragmentation of large multiply-charged produces those differential C & Z ions to garner those critical insights.

> High EAD
small molecules

CID fragmentation of small molecules can produce limited and/ or non-specific MS/MS information, giving rise to challenges in identification or lack of specificity in the development of quantitative assays.

Highly sensitive quantification and selective identification of pesticides in food with Zeno MRM^{HR}

Using the SCIEX ZenoTOF 7600 system, powered by SCIEX OS software

Robert A. Di Lorenzo, Lukasz Rajski, Jianru Stahl-Zeng, Jason Causon
SCIEX, Canada; EURL-FV, Universidad de Almeria, Spain; SCIEX, Germany

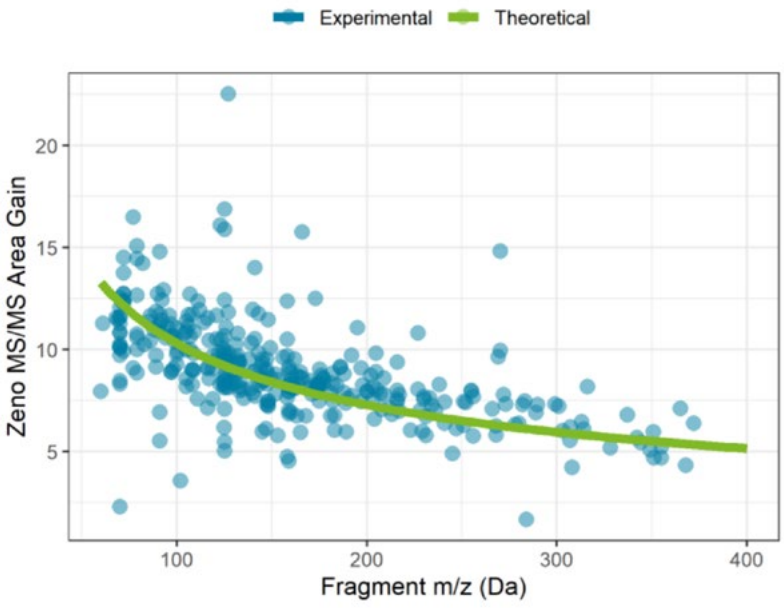
Abstract

Using the sensitivity enhancements of the Zeno trap, Zeno MRMHR is used to quantify low levels of pesticides in oilve oil and various fruits and vegetables to meet global regulations for pesticide residues. Over the mass range analyzed, the Zeno trap allowed for signal gains of 5-15x, with negligible increase in noise due to the selectivity of MRMHR analysis, hence gains were directly related to improved LLOQs. The selectivity and specificity afforeded by the accurate mass MS/MS quantitation on the ZenoTOF 7600 system allowed for highly confident identifications of pesiticdes in real food samples (MS and MS/MS mass accuracy, library matching, isotope ratio matching), while still maintaining triple quad-like ability to perfom ion ratios for confirmations.

Introduction

In order to ensure safety in the global food supply, testing for adherence to federal and international requirements is necessary. The tests monitor for chemical residues, including pesticides, microbial and fungal toxins, and microbiological hazards. Considering the ever-growing demand on the food supply, farmers and producers are tasked with optimizing yields, which means employing the use of pesticides to deter pests from harming their crops. For this reason, it is important to be aware of adherence to pesticide maximum residue limits set by the appropriate governing bodies.

Traditionally, pesticide residue analysis has been performed by triple quadrupole mass spectrometers, due to their sensitivity and quantitative power. Accurate mass instruments can afford additional levels of confirmation, however they have traditionally suffered from a lack of sensitivity and precision, especially when performing MS/MS experiments to meet the testing requirements for the regulatory guidelines. The technological enhancements afforded by the ZenoTOF 7600 system, however, bring QTOF systems into a new era of sensitivity and precision.



Go to full technical note →

X500R QTOF system

Go to webpage →

Be ready for anything with quantitative and qualitative capabilities on the same instrument
For the modern researcher who needs flexible and scalable workflows that deliver reliable, high-quality, accurate mass results with confidence, the X500R will quickly become your workhorse. Built specifically to balance robust performance with triple-quad-like quantitation, you can perform everything from untargeted analysis to broad screens, comprehensive profiling, and identification of unknowns, all on the same instrument. With simple workflows, robust hardware, sensitivity, and precision, the X500R QTOF is the first high-resolution LC-MS/MS system designed for both characterization and quantitation.

Key features of the X500R system:

> Mass range TOF

Up to 40 kDa. Precursor ion selection: 5-2250 m/z.

> Mass accuracy over time, external

Less than 2 ppm RMS over 12 hours of LC-MS

> Ionization sources

Turbo V ion source with twin sprayer ESI probe and twin sprayer APCI probe

> TOF-MS resolution and speed

≥ 42,000 (FWHM) measured on the (M+6H)6+ charge isotope cluster for bovine insulin at m/z 956.

Technical content summaries

Technical content summaries
Contents

Mycotoxins

Technical content summaries

Quantification of Aflatoxin M1 in Milk Using the SCIEX QTRAP 4500 System

India, Germany

Aflatoxin M1 is a toxin that can be found in milk and milk products due to contaminated feed. This toxin can cause serious health effects in children, resulting in stringent monitoring requirements for aflatoxin M1, but determination is difficult due to the complexity of the sample matrix. This technical note describes a robust method developed using the QTRAP 4500 system for the quantitation of aflatoxin M1 in milk. The method was validated according to the European Commission Decision 2002/657/EC and meets local India guidelines for maximum residue levels of this toxin—0.5 ppb (500 pg/mL)—in milk.

Robust, high-throughput, fast polarity switching quantitation of 530 mycotoxins, masked mycotoxins and other metabolites

Mycotoxins are toxic fungal metabolites, which are derived from certain molds and fungi. The growth of mold can occur before crops are harvested or under inappropriate storage conditions such as warm and humid conditions. Consumption of food products containing mycotoxins can have serious health implications. According to the World Health Organization (WHO), the effects of some foodborne mycotoxins are acute, with symptoms of severe illness appearing quickly after consumption.[1] Others have been linked to long term human health effects, such as cancers or immune deficiency.

Simultaneous analysis of 26 mycotoxins in grain on a SCIEX Triple Quad 3500 system

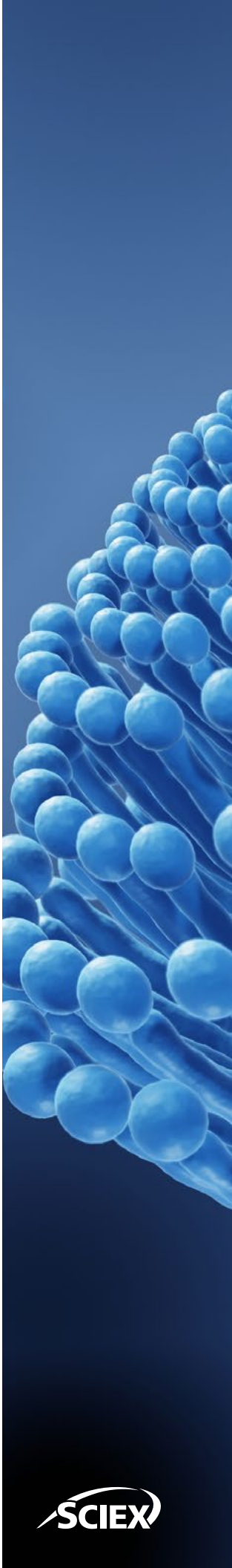
China, Singapore

Fungi are known to produce secondary metabolites, such as mycotoxins, that contaminate agricultural commodities and pose a threat to human health and animal safety. For this reason, many countries have regulations in place for mycotoxin detection and their permissible limits. This technical note—which focuses on mycotoxin limits in China and testing regulations that require using confirmatory techniques—describes a single workflow to analyze 26 compounds simultaneously that was validated in different grain matrices.

Analysis and Quantification of Mycotoxins in Cereals Using a Time-Scheduled MRM^{HR} workflow

China, England

Abnormal climate conditions and insect damage have caused extensive mycotoxin contamination of grain in recent years, leading to severe damage, huge losses and threats to human and animal health. This technical note describes the detection of common mycotoxins in grain using a targeted high-resolution MRM approach for quantitative product ion detection, qualitative product ion detection and qualitative confirmation at high scanning speeds. Using wheat and corn as testing matrices, this work demonstrated mycotoxin prevalence and its contamination of grain samples, highlighting the need for greater monitoring and oversight.



Veterinary drugs

Technical content summaries

High sensitivity and dynamic range for veterinary drugs analysis with the SCIEX 5500+ system

France, Germany, Switzerland, USA

Veterinary drugs are commonly used in livestock breeding to prevent or treat infections and to ensure optimal growth. For safety and regulatory reasons, the ability to quantify any residues of these drugs in products of animal origin is critical. Here, a highly selective and sensitive LC-MS/MS method for the analysis of veterinary drugs is presented that uses the SCIEX 5500+ system together with SCIEX OS software for a targeted quantitation/screening workflow. A mixture of 218 veterinary drugs with different compound classes—such as corticoids, quinolones, sulfamides, macrolides, tetracyclines and many others—are included in this study.

Ultra-high sensitivity quantification of veterinary drug residues in products of animal origin

The use of pharmacologically active substances in veterinary settings has been scrutinized for several years due to their sometimes inappropriate or excessive use. This is particularly worrying to authorities due to possible allergic reactions and increasing antibiotic resistance in both livestock and human populations.[1] Therefore, the use of these substances must be controlled and limited to mitigate these issues. One way this control is implemented is through testing products of animal origin. In these analyses, compounds of interest have a set maximum residue limit (MRL), intended to reduce the levels of These compounds. Some compounds have been prohibited altogether, due to their inherent toxicity.

Combining SWATH® Acquisition with MRM^{HR} for the analysis of veterinary drugs in Tissue

Germany

Veterinary drugs that find their way into human nutrition represent a potential risk to human health, and abuse of antibiotics in animals may also contribute to the development of antimicrobial resistance. For these reasons, regulatory bodies require careful control of the presence of veterinary drug residues in animal products. This technical note presents a highly flexible, selective and sensitive LC-MS/MS method for the analysis of veterinary drugs in liver extract using the X500R QTOF system and SCIEX OS software for a combined non-targeted and targeted screening workflow.

Analysis of Metronidazole and Ronidazole in Milk with the 3500 System

India/Germany

The use of antibiotics in cattle ranching, poultry and other farming is a major concern due to the potential impact of these substances on human health. This technical note describes the successful analysis of both metronidazole and ronidazole in a milk test matrix using the SCIEX Triple Quad 3500 system in combination with a simplified sample preparation protocol. A simple extraction procedure was used that detected the presence of these antibiotics down to sub-single-digit ppb levels to help ensure that recommended safety levels are met for local regulations.

Simultneous quantification of aminoglycoside antibiotics in milk with the SCIEX Triple Quad 3500 system

India/Germany

Aminoglycosides (AGs) are broad-spectrum antibiotics that have been extensively used in both human and veterinary medicine. However, AGs can be a risk to consumer health if they are present at levels that are too high. Here, to measure AG residues in milk, a fast and robust sample preparation procedure was developed based on buffer extraction and without the need for a cleanup step. Various analyses of milk samples confirmed the ability to detect trace-level concentrations of AG antibiotic residues.

Simultaneous determination of 88 veterinary drug residues in pork liver using LC-MS/MS

China

In recent years, the use of illicit drugs in animal breeding and husbandry has become increasingly widespread, and the presence of residues of these drugs in animal-derived foods is a growing safety concern. In this technical note, a quantitative method is described for detecting 88 kinds of prohibited veterinary drugs on the QTRAP 4500 system using pig liver as a test matrix. This method provides a simple and efficient solution for the detection of veterinary drugs and illegal added drugs in food of animal origin.

Pesticides

Technical content summaries

Highly sensitive quantification and selective identification of pesticides in food with Zeno MRM^{HR}

Canada, Spain, Germany

The safety of the global food supply requires adherence to pesticide maximum residue limits set by governing bodies around the world. In the workflow described here, Zeno MRMHR is used to quantify low levels of pesticides in olive oil and various fruits and vegetables to meet global regulations for pesticide residues. The selectivity and specificity afforded by the accurate mass MS/MS quantitation on the ZenoTOF 7600 system allowed for highly confident identification of pesticides in real food samples (through MS and MS/MS mass accuracy, library matching and isotope ratio matching) while maintaining triple quadrupole-like ability to perform ion ratios for confirmations.

A robust and sensitive method for the direct analysis of polar pesticides in food and environmental samples without derivatization

The prevalence of multi-residue LC-MS/MS analyses for the quantification of pesticides in food and environmental samples has been steadily increasing for many years, and they are now considered to be a minimum requirement of most laboratories working in these fields. Modern tandem quadrupoles are capable of detecting such regulated compounds at very low levels with minimal sample preparation, such as QuEChERS, thereby enabling labs to process large numbers of samples for many analytes with a fast turnaround.

Quantification of acetamiprid and prochloraz in black pepper with the 3500 System

India, Germany

Single digit ppb levels were achieved on the 3500 System, below the Maximum Residual Limit (MRL) outlined by FSSAI (10ppb) and the European Union (100ppb). This method performed as per commission decision SANTE/11813/2017 directive recommendations and fulfils regulatory requirements fort sensitivity, prevision, and accuracy. Monitoring pesticide residues in pepper samples have never been easier.

Precise testing of pesticides in food using the SCIEX Triple Quad™ 7500

Canada, Germany, England, Holland

The SCIEX Triple Quad 7500 LC-MS/MS System - QTRAP Ready provides impressive levels of sensitivity, robustness and accuracy for trace level analysis of pesticide residues in food matrices. Here, over 1400 MRM transitions for 700 compounds were analyzed in a single analysis achieving quantification limits of 0.2 ng/mL for the majority of the pesticides tested.

PFAS in food

Technical content summaries

Measuring PFAS in a variety of food samples at different price points

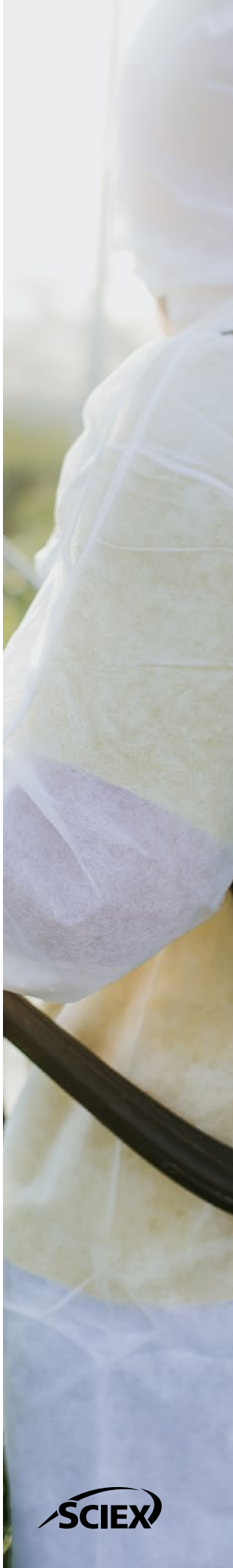
Recent studies have shown that per- and polyfluoroalkyl substances (PFAS) accumulate in the food chain and are found in a wide variety of food products, including fish, meat, dairy and vegetables. As a result, there is a growing concern about the potential health risks associated with consuming PFAS-contaminated foods. As the public becomes more aware of these compounds, they might make purchases that they believe would decrease the amount of potential exposure to PFAS. Many people may assume that more expensive alternatives might represent a healthier or less PFAS-contaminated option. This study explored the differences in PFAS concentrations in several food types at different price points.

Measuring per- and polyfluoroalkyl substances in baby formula powder: A quantitative LC-MS/MS approach

This technical note describes the trace-level analysis of per- and polyfluoroalkyl substances (PFAS) in infant formula following the AOAC Standard Method Performance Requirements (SMPRs) for PFAS in produce, beverages, dairy products, eggs, seafood, meat products and feed. Using the SCIEX 7500 system, the method detection limits (MDLs) for 34 different PFAS in baby formula powders ranged from 0.5 ng/kg for PFOSA to 71 ng/kg for PFBA. These results met the required MDLs outlined in the AOAC SMPRs.

Nontargeted and suspect screening of per- and polyfluoroalkyl substances (PFAS) in food contact materials

This technical note demonstrates the nontargeted and suspect screening for PFAS in food contact materials (FCMs) using SWATH data-independent acquisition (DIA) on the X500R QTOF system. Comprehensive MS/MS coverage from SWATH DIA enabled nontargeted and suspect screening for unknown and PFAS previously reported in FCMs. Several classes of PFAS comprised of precursors, degradation intermediates and terminal metabolites, were identified at varying levels of confidence, including a legacy compound that had been phased out in commercial products since the early 2000s.1



Food contact materials

Technical content

Identification and quantification of PFAS in food contact materials using MRMHR workflow on X500R QTOF system

China

PFAS are widely used in plastic packaging materials for food and as coating in nonstick pans. Given the tremendous persistence of PFAS in the environment and their adverse effects on human health, monitoring of PFAS residue has gained traction in China and elsewhere. This technical note describes the use of the X500R QTOF system with the MRMHR acquisition mode to enable detection and quantitation of PFAS and to meet EU regulations and national standards in China.

Rapid identification and quantification of 27 primary aromatic amines in kitchen utensils

In this technical note, a method was developed to analyze 27 primary aromatic amines (PAAs) in food contact materials (FCMs). The method achieved LOQs of 0.001-0.50 ng/mL, which correspond to detection limits several orders of magnitude lower than EU regulation mandate. In addition, the high sensitivity of the SCIEX 7500 system permitted dilution of the sample extracts to reduce matrix effects and improve data quality, as shown by the high accuracy and precision (%CV <15%) of spiked matrix samples.

Determination of Irganox compounds extracted from food packaging using 4 food simulants

India, England, Germany

Human health can be impacted by chemicals that migrate into foods and beverages from food contact materials (FCMs), such as wrappers and containers. Understanding the risk of FCM chemicals requires a sensitive and accurate analytical method. The method presented in this technical note accurately identified and quantified 16 Irganox compounds that were spiked into normal food matrices in extracts of plastic food packaging materials. This technique eliminated the need for matrix-matched standards while achieving accuracy and precision criteria, allowing for a simpler sample preparation procedure.

Simultaneous quantitation and confirmation of per- and polyfluoroalkyl substances (PFAS) in food contact materials

Canada, USA

This technical note demonstrates the simultaneous quantitation and identification of PFAS in food contact materials (FCMs) using MRMHR acquisition on the X500R QTOF system. The greater selectivity from high-resolution fragments provided cleaner chromatograms with lower background noise for more sensitive quantitation. At the same time, the high QTOF mass accuracy increased analyte specificity for more confident identification.

A new level of accurate quantitation for 29 phthalate esters in food simulants using LC-MS/MS

USA, Germany

This technical note demonstrates a novel LC-MS/MS method that quantified 29 phthalate esters (phthalates, PEs) at ng/mL (ppb) detection limits in 4 food simulants, as described by the EU regulation on plastic food contact materials.1 Laboratory methods were improved to reduce background contamination, yielding limits of quantitation (LOQs) as low as 0.025 ng/mL for most PEs using the QTRAP 6500+ system. In addition, 9 PE isomers were chromatographically separated during the 20-minute gradient run using a reversed-phase LC column (Figure 1). The method was applied to a real-world juice sample and post-extraction spikes showed good accuracy and precision.

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USA, Germany

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Combined qualitative and quantitative analysis of food packaging materials using the ZenoTOF 7600 system

Germany

In this technical note, a comprehensive, accurate mass spectrometry method for the characterization of extractable and leachable (E&L) compounds in food packaging was developed. Using the ZenoTOF 7600 system, 3 workflows were explored: suspect screening, unknown screening and MRMHR quantitation (Figure 1). The combined workflows demonstrated the benefits of each acquisition mode to fully characterize and quantify compounds in a food contact material. Both NIST and SCIEX MS/MS libraries were used to streamline the data processing workflow, reducing the number of compounds that required manual review.

Allergens

Technical content summaries

Detection of sesame peptides and 12 other food allergens using the SCIEX vMethod for food allergen testing

In 2021, the Food Allergy Safety, Treatment, Education, and Research (FASTER) Act was passed in the United States. The FASTER Act requires all foods sold in the United States that contain sesame to declare it as an ingredient or state "Contains: Sesame" immediately after the ingredient list.

The SCIEX vMethod application for food allergen testing previously provided a workflow for sample preparation and LCMS/MS detection of 12 distinct allergens, including egg, milk, almond, Brazil nut, cashew, hazelnut, pine nut, pistachio, pecan, walnut, peanut and soy.

vMethod Application: A Highly Selective and Sensitive LC-MS/MS method for the Quantification of Gluten Proteins

Singapore, India, Canada, Germany, USA

For those with gluten-related disorders, consuming gluten can have serious health consequences, making the detection and quantitation of dietary gluten in prepackaged foods extremely important. Here, a highly selective and sensitive LC-MS/MS method is described that screens and quantifies wheat gluten proteins in various food matrices, including bakery products, fermented beverages and baby formula. This method measures unique, stable signature peptides using predetermined multiple reaction monitoring (MRM) transitions for identification and quantitation, and it accurately detects gluten protein concentrations as low as 5 ppm.

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Residuals

Technical content summaries

Acrylamide quantitation in a diverse range of food matrices

India, USA

Acrylamide is known to increase the OVA-induced (ovalbumin or albumin) food allergen response in some populations. This naturally forming byproduct promotes the Th2 cell response to modulate the imbalance in Th1/Th2. Typically found in fried foods, acrylamide can impair the intestinal epithelial barrier, causing increase amounts of OVA passage.

Rapid determination of Aconitum alkaloids in adulterated spice powders

India, USA

What gives food flavor?
Most of the cuisines around the world use a variety of spices and food powers to add to the flavor profile of foods. Exceptions to the rule occurs when some manufacturers add adulterated compounds to the mix, resulting in the presence of aconitum alkaloids which are toxic, and may cause nausea, vomiting, heart problem, and can be fatal.

Acrylamide analysis in ground coffee using a novel extraction method

India, USA

Coffee drinkers: roasted or instant? While acrylamide is a natural byproduct of the chemical reaction between sugars and asparagine, there can be varying amounts of this in your coffee depending on the production method, and where it comes from. Instant coffee is found to contain as much as twice the amount of acrylamide than freshly roasted coffee. What does this mean?

Nitrosa ine analysis in a variety of food matrices

India, USA

Everything from milk, oats, chicken, to fish and prawns, may contain levels of nitrosamines that can potentially be harmful depending on their concentration and breakdown pathway that is matrix-dependent. Check out this method on how some scientists determine nitrosamines presence and levels in a number of matrices.

Rapid detection and identification of 105 performance-enhancing substances in animal-derived foods

Asia, china

In this technical note, a comprehensive screening method for the analysis of 105 common performance-enhancing substances in animal-derived foods was developed. Using the SCIEX QTRAP 4500 system, multiple reaction monitoring (MRM)-trigged enhanced product ion (EPI) scans allowed for the simultaneous acquisition of highly sensitive MRM quantitation data and MS/MS spectra for compound confirmation using library searching

Sensitive quantitation of nitrosamines in multiple foodstuffs using the SCIEX 7500 system

UK, Germany

In this technical note, chromatography and mass spectrometry methods were developed to quantify 15 nitrosamines in malt, sausage and fish. Limit of quantitation (LOQ) values as low as 0.01 µg/L in solution were achieved for multiple compounds due to the sensitivity of the system used, with linear ranges spanning up to 4 orders of magnitude.

LC-MS/MS quantitation of artificial sweeteners in beverages

India, USA

This technical note describes a direct injection method for the analysis of 9 artificial sweeteners in beverage samples (advantame, saccharin, sucralose, aspartame, acesulfame K, stevioside, rebaudioside, neotame, and sorbitol). Using the SCIEX QTRAP 4500 system, the in-sample limits of quantitation (LOQ) ranged from 0.125 µg/mL for acesulfame K to 10 µg/mL for sucralose. Matrix spikes in a cola beverage (n=5) showed mean accuracies between 72% and 107% for the 1x LOQ spike, and between 91% and 114% for the 5x LOQ spike.

Simultaneous quantitation and identification of 6 mushroom toxins in poisonous mushrooms using the SCIEX 5500+ system

China, Australia

This technical note describes the simultaneous quantitation and identification of 6 mushroom toxins in a single injection using the SCIEX 5500+ system. The use of multiple reaction monitoring (MRM) to trigger the acquisition of enhanced product ion (EPI) scans produced both MRM data for quantitation and MS/MS spectra for qualitative identification

SCIEX food fraud guide

Go to webpage →

Tackle food fraud with this informative guide. Use the buttons below to discover the latest trends and tools for your organization.

"Get ready to gear up your lab for exceptional food analysis to detect vulnerabilities across the food supply chain."

In this Food Fraud Guide, we clearly define food fraud, and examine the extent of the problem and take a look at some of the work scientists around the globe are doing to combat the ever-changing tactics of food fraudsters. The guide uncovers the amazing work being done by food testing laboratories using different SCIEX liquid chromatography-mass spectrometry (LC-MS) and capillary electrophoresis (CE) instrumentation to stay abreast of these ever-changing issues. Get ready to gear up your lab for exceptional food analysis to detect vulnerabilities across the food supply chain. Use this guide to gain new insights into understanding the extent of food fraud within the industry and ultimately take the right measures to protect consumers.

ROI Calculator

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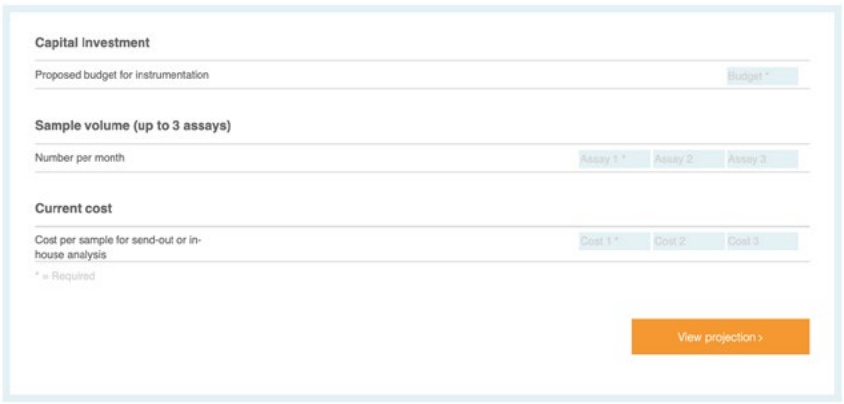
Let us help answer that age-old question with a custom Return on Investment (ROI) calculation specific to your business.

Understand your return on investment (ROI)
SCIEX Calculator

Return on investment can be used to determine the profitability associated with capital expenditures for your organization.
SCIEX offers this tool to help you explore the financial value a mass spectrometer can bring to your laboratory.



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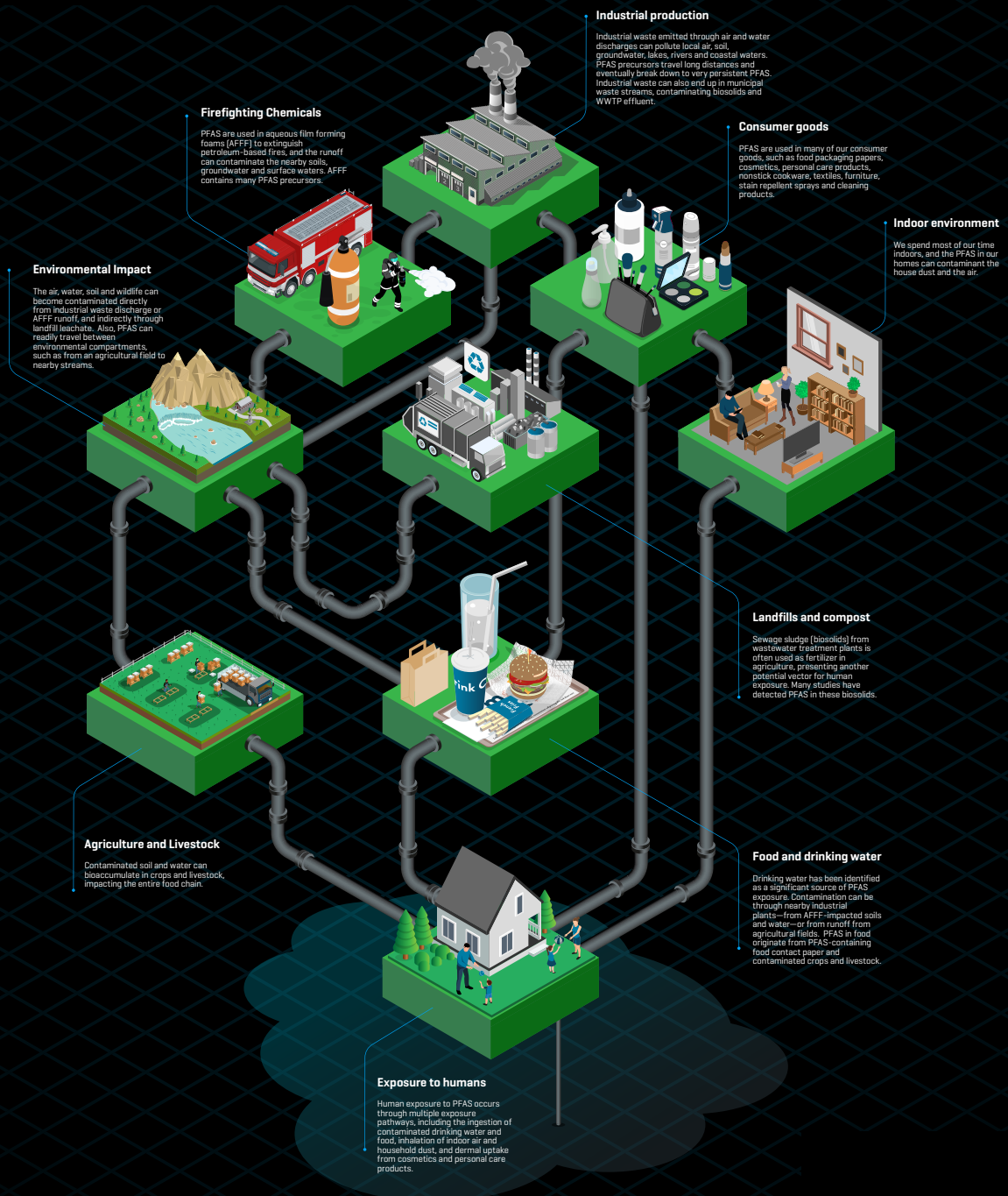
PFAS lifecycle

Where food plays a part

Learn more →

While exposure to per- and polyfluoroalkyl substances (PFAS) has been a dominating focus in health-related news cycles, awareness of the food component of the PFAS exposure journey has been growing—especially since food-related exposure extends beyond food consumption to include food contact materials (FCMs) and the potential long-term effects for humans.

The above infographic maps out the entire PFAS life cycle, where food testing and safety play both large and small roles. The next section evaluates various types of applications in food testing that can uncover how food and PFAS are linked in more ways than one.



The trials of a food tester

Watch the webinar on-demand →

It is a great feeling to know that you are buying food that is safe to eat when you go to the grocery store. We have the food safety testing industry to thank for that. Food scientists work day-in and day-out testing food for contaminants and/or nutritional value, developing new methods to better test food for those assorted compounds, and surveying food samples for potential unknown residues, adulterants, or other components.

Food scientists have a number of things to consider when approaching a food testing workflow. The most critical is finding a contamination – an error could have devastating consequences, including consumer health impacts and product recalls.

Top considerations in food testing

Food samples are innately complex, making food analysis a challenge. Food products contain an assortment of chemical compounds, from proteins, carbohydrates, fats, and vitamins (healthy compounds) to residues and contaminants (unhealthy compounds). It is the job of the food tester to find anything unwanted, or potentially hazardous, among all the good.

Food samples are also perishable, so testwing must be done in an efficient and timely manner. Food testing labs are often faced with stringent sample turnaround deadlines – they are not only pressured to produce accurate results, but must do so under significant time constraints.

Technical steps in food testing

The food testing workflow contains many steps – first, residues of interest must be extracted from the food sample. Then, any interfering or unwanted matrix components (such as the proteins, sugars, or other endogenous compounds) must be removed to reduce their impact on the measurements. Next, the samples are analyzed using the appropriate technology. The data is processed, and any findings reported. Each of these steps must be strategically considered and optimized to ensure the best results for the analysis.

The Power of Precision

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