



## **Trust to Taste**

- Food safety, quality, authenticity – from farm to table

# Recipes for better food safety, quality and authenticity

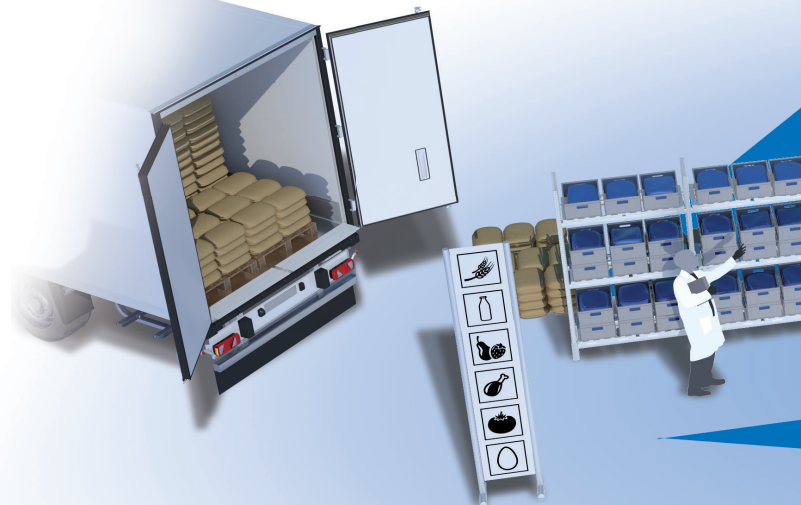


*The globalized food supply chain poses serious challenges to producers, brands, consumers and government agencies. An ever-intensifying worldwide competition, a growing number of contaminants and a strong demand for food quality controls are constantly increasing the number of stringent regulations and the need for standardization.*

*At Bruker, we use our analytical knowledge to safeguard the quality and safety of food and beverages, animal feed and agricultural products throughout the whole supply chain – from product development and production through to quality control and incoming goods inspections. We offer complete systems to reliably identify micro-organisms and organic molecules and quantify compounds and trace elements.*

## Good food, better life – A path to consumer fidelity

Increased demands from customers for safe and wholesome food, the increasingly complex food chain with import and export control on ingredients and intermediates, and ever more stringent regulatory requirements: all these factors are constantly creating new challenges for food and beverage producers and QC providers. Bruker provides an extensive range of complete analytical solutions to monitor the entire food chain, from farm to table.



Raw materials, directly from harvest site or pre-processed food ingredients, may be analyzed in real-time to support safety, quality and authenticity in production and distribution workflows

● Solutions for food ingredient and product analysis

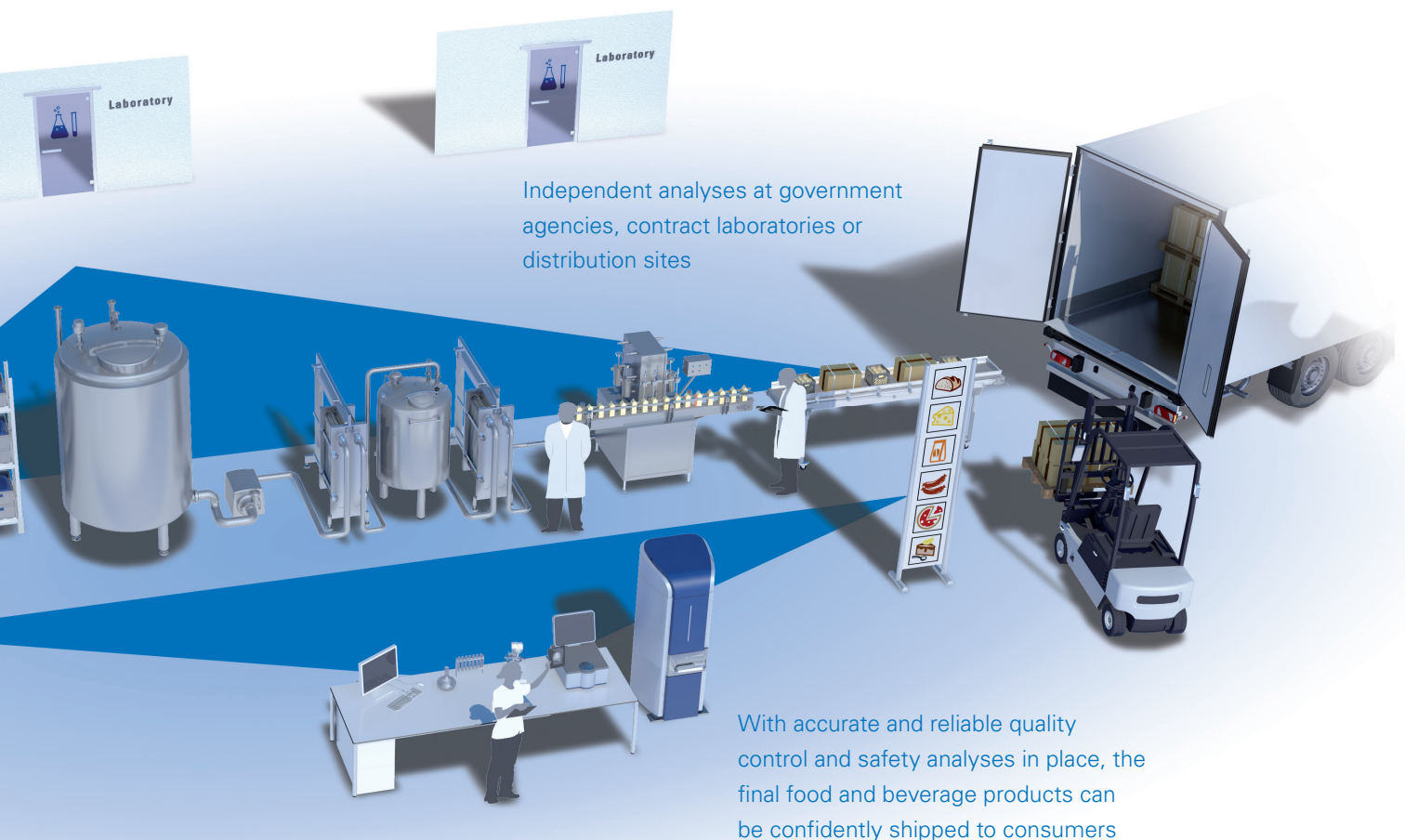
## Bruker's solutions contribute to the optimization of food quality and food safety control throughout the entire supply chain

Consider that "healthy" yogurt in the refrigerated display case at the market ... what compositional analysis and quality controls are part of its path to consumers?

Antibiotics or growth hormones may have been used on the cows that produced the milk, or pesticides used on the fruit used for flavoring. Bruker's technologies can detect them. Potentially harmful chemicals may have been used as colorants, sweeteners, or as additives to extend its shelf life, and chemicals from the yogurt packaging may be leaching into the product. Bruker's technologies can find them.

Organoleptic and health benefits of yogurt are due to positive bacteria. Reliable quality controls along the fermentation processes and during storage are fundamental to guarantee the stability of the starters and the absence of unexpected microbial contaminants. Bruker's technologies can make such evaluations. Yogurts can also be an excellent source of calcium and good fats such as omega-3 fatty acids. Bruker's technologies can precisely determine those levels. Honey may be preferred as a natural sweetener or topping, but can you be certain of its source authenticity? With Bruker's technologies, you can.

Food quality, quality control, food safety, food authenticity and food fraud: For critical needs, Bruker provides complete solutions.





## Food Quality

*Is it fresh? Is it pure? Is it functional? Questions and concerns regarding food quality are endless, and the demand for ready tools to define, monitor, and ensure the integrity of foodstuffs is growing around the world, from small markets to giant production facilities.*

- + Identification of raw materials**
- + Quality control**
- + Composition analysis**
- + Elemental analysis**
- + Hygiene control**
- + Process control**

## Identification of raw materials

FT-IR, FT-NIR and handheld Raman instruments can be used to build specific reference spectral libraries and identify materials across the entire production chain – from the raw materials, through all intermediates, to the finished products.

## Elemental and composition analysis

Accuracy and speed are key for elemental and composition analyses of foods and beverages, whether for levels of mercury in tuna or the iron content of fortified milk powders, or for more complex evaluations such as the determination of the complete fatty acid profile of edible oils or the nutritional value of whey protein concentrates.

Composition analysis of protein, fat, moisture/dry matter, ash, fiber, sugars and other parameters are easily performed by FT-NIR technology on various ingredients and products in liquid, solid or semi-solid forms. This is commonly applied in quality control of milk and dairy products, meat, grain, flour, oil seeds, condiments, confectionary, and beverages as well as in process control.

Elemental analysis by XRF (x-ray fluorescence) offers a path to analyze a wide array of products used by consumers on a daily basis – from flour to rice, chocolate, and pet foods – and may be used in a rapid, non-destructive manner in-situ or for ash content analyses as part of quality or regulatory requirements. Even at trace levels, potentially hazardous metals such as lead and arsenic may be sought, as well as potential metallic contaminants from blending, grinding, and mixing processes.

## Oil and fat characterization

Analyses of oils and fats according to AOCS and ISO standards can be challenging, but Bruker's TD-NMR measures the oil and moisture content in seeds, nuts and other dry food products with high accuracy. In addition to the determination of the total fat content in cacao and chocolate products, TD-NMR can be used to measure the solid fat content (SFC) in margarine, butter and spreads at different temperatures and to measure the droplet size distribution of water droplets in fats (e.g. in margarines) and oil droplets in water (e.g. in mayonnaise).

Oil and fat analyses by FT-NIR provide characterization of Iodine Value (IV), Free Fatty Acids (FFA), fatty acid profiling (including the level of undesirable trans fats), as well as oxidation status. Moreover, the rapid determination of individual omega-3 fatty acids in marine oil supplements enables producers to perform a timely production control.

## Control analyses of technological strains and microbial spoilers

The desirable fermentation and ripening processes that give fermented foods and beverages their organoleptic properties rely on the metabolisms of local technological microflora or commercial starters, and the need for improvement of production methods and process economics is constant. Likewise, testing for spoilage organisms which may lead to product losses is a critical function of QC laboratories in food and beverage industries.

The MALDI Biotyper and IR Biotyper platforms provide rapid and reliable identification and fingerprinting of positive microflora, quality indicators and other microbial contaminants to screen raw materials and ingredients, to optimize the storage conditions, to control the process and hygiene conditions, or for sterility assessment. The MALDI Biotyper and IR Biotyper enable specific identification and typing of microorganisms within minutes. Implementing the platforms in microbial QC workflows can directly translate to significant cost savings by accelerating testing along the entire process chain.

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# Quality Control

*Stringent quality control mechanisms help to establish key defenses towards food safety and integrity. With an eye to safeguarding human and animal health, quality control checks can also reduce costly product failures while supporting consumer confidence.*

*Successful monitoring of the integrity of food and beverage products relies on accurate and reliable technologies, and the analytical needs are often diverse. Practical tools to screen for contamination before products leave the production facility serve a critical role. Testing may include stability assessments or composition determination to ensure expected levels of proteins, fats, or nutrients are maintained from batch to batch.*



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## Packaging testing

Modern food packaging sciences have changed the way food and beverages are preserved, marketed and distributed around the globe.

Bruker's family of LC/MS and GC/MS platforms provide a proven route for the detection of potential migratory chemicals from plastics, including solvents, inks, polymers, acrylamide, 2,4,6-trichloroanisole (TCA) and bisphenol-A (BPA).

Bruker's FT-IR macroscopic and microscopic analysis tools enable the verification of packaging material quality, including the absence of surface oxidation, the presence of coatings, or the composition of multi-layer laminates.

In-situ analyses targeting hazardous elements in plastics, polymer films, and cans commonly used in food packaging may be quickly made with Bruker's XRF instruments.

## Shelf life

The action of free radicals in edible oils and beer can cause costly spoilage, rancidity and staleness via product oxidation. The free radical process is oxygen and temperature dependent, and improper processing, transport, or storage can promote or accelerate this action, resulting in undesirable aldehydes, ketones and alcohols that dramatically decrease shelf life.

Bruker's EPR instruments can quickly quantitate free radicals, and can be invaluable at many production and distribution stages. In the laboratory, free radical formation within a given product can be monitored during forced oxidation experiments and the potential preventive benefit of the addition of antioxidants can be determined. Likewise, measurements taken within a production facility (for example, blending and bottling) can be used to develop protocols to minimize free radical formation.

Long distribution channels can also challenge product freshness and shorten utility to the end user, therefore the determination of the oxidative status of edible oils by FT-NIR spectroscopy upon delivery or following storage can be invaluable.

## Product failure

While product failures are often limited to profit and product loss from premature spoilage, greater risks to human and animal health can result from unintentional contamination of food products.

Using Bruker's FT-IR microscopy and XRF platforms, impurities and foreign objects in food products, such as plastic and metal parts, fibers, chemical residues, and other particles may be quickly identified in order to detect the source and scope of contamination.

A photograph of a man with a beard and short dark hair, wearing a blue denim shirt and khaki pants, carrying a young child in a dark blue patterned baby carrier. The child is wearing a pink long-sleeved shirt, blue jeans, and white sneakers. They are walking in what appears to be a grocery store or market, with blurred shelves and products in the background. A red dot is visible in the top left corner of the page.

## Food Safety

### Rapid testing for contaminants and residues

Unless specifically marketed as 'organic', most healthy fruits and vegetables available at our local markets are exposed to chemical pesticides and herbicides during growth, and both fresh produce and plant derived food products may carry residues from this exposure. Growth hormones and/or antibiotics administered in animals raised for food may be detected in fresh meats and meat products, as well as in dairy foods, farmed fish and shellfish.

Processed foodstuffs may be exposed to potentially carcinogenic and/or mutagenic chemical byproducts of food processing, such as acrylamide, or 3-monochloropropane-1,2-diol (3-MCPD), or dye additives, such as Sudan Red. The consumption of mycotoxins and dioxins, both naturally occurring and as processing byproducts, also presents significant health risks to both humans and animals. Many of these compounds and toxins are monitored and regulated by government agencies in an effort to better protect public health.

Bruker's family of LC/MS and GC/MS platforms are designed for rapid targeted and non-targeted screening for legislated contaminants with high accuracy and sensitivity across all food types for compliance with import/export regulations and consumer safety guidelines.

Dedicated software packages (TargetScreener HR and TASQ) enables the analyst to rapidly assess with complete confidence if a sample complies to the required regulations.





## Fast identification and tracking of pathogens and hygiene indicators

Microbiological pathogens can also pose considerable risk for human and animal health. Fast and reliable testing controls are necessary, and without any inconclusive data. Using the same workflow for all micro-organisms and automatically transferring the identification results to LIMS, the MALDI Biotyper® enables easy pathogen confirmation from selective and non-selective culture media within minutes. Beyond identification, the IR Biotyper® platform may also be used for fast fingerprinting.

Integrating MALDI Biotyper into routine testing workflows results in a significant consolidation of resources, as it replaces multiple traditional and biochemical identification methods. Typically, no more than an isolated colony from a culture plate or a small aliquot from a broth is required. The entire method takes only a few minutes for a single sample and less than one hour for 96 samples, with results up to 24 hours faster than traditional methods. The integrated library of the MALDI Biotyper is comprised of reference spectra of thousands of strains including bacteria, yeasts and fungi. The library is continuously maintained and updated according to strict quality-controlled procedures. In addition, the IR Biotyper platform facilitates fast microbial fingerprinting and contaminant tracking, with minimal hands-on time and a time to result of less than three hours.

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# Food Authenticity and Food Fraud

*Food fraud for economic gain is an age-old crime, but Bruker's family of analytical instrumentation provides many tools to determine a product's authenticity or detect adulteration.*

Food samples can be routinely analyzed by FT-NIR for composition analysis while a simultaneous screening for adulteration by an identification and conformity test can be readily developed. Mass fingerprinting by MALDI-TOF can be used to create protein profiles for specific types of fish and meat to quickly identify lower-cost "imitations". Similar workflows can also be used to screen for adulteration in edible oils, such as olive oil, through the fast and easy analysis of their acylglycerol profiles.

## Is it really a 'Bordeaux' wine?

Bruker's push-button FT-NMR FoodScreener™ is designed for detailed authenticity testing of food products. Specific profiling modules for fruit juice, wine and honey provide a rapid path to both targeted and non-targeted analyses. In these products, the geographical region of collection and botanical origins can be verified within the models. With honey, adulteration with common (lower cost) sugar syrups can also be detected. Likewise, in wine, authenticity parameters like geographical origin, grape variety and vintage year can be quickly verified using a spectral database of nearly 20,000 reference samples.



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# Analytical tools with global dimension

## Meeting demands for monitoring food quality and safety

The global nature of today's food and beverage industry has largely benefited consumers, with a wider array of products to meet every taste and need. At the same time, technological innovations have provided better means for quality assurance and detection of potential risks, but continuous diligence is required.

The governmental bodies serving as global references for food safety and authenticity have expanded their oversight and regulation of food and beverage industries. As part of broad regional legislation, the creation of national food safety authorities and administrations are designed to better protect human health and ensure high nutritional values, while the Codex Alimentarius provides the "Food Code" worldwide. Additionally, the WHO's International Food Safety Authorities Network (INFOSAN) and the Food and Agriculture Organization of the United Nations (FAO) have worked to promote food safety and quality around the world.

Bruker's family of analytical instrumentation enables accurate and reliable detection of regulated or potentially harmful agents and workflows for assessment and monitoring of the quality and integrity of raw materials and products across all food and beverage supply chains and production processes. With platforms amenable to a range of analytical needs – from spot inspections at a shipping and receiving dock, to quality management in laboratories with extensive LIMS, to analytical examinations by food safety authorities, to product and brand protection and promotion – Bruker has the tools and technology to support the demands for safety and integrity of foodstuffs around the world.



# Food safety, quality and authenticity

The need for control in the food and beverage industry has been recognized for thousands of years, with many concerns shared in the present day. Early regulations were frequently focused on food frauds, including the intentional use of additive fillers for higher profit margins, but the use of chemical fertilizers and pesticides introduced new potential risks to human and animal health.

During the 1800s, microbiological discoveries and developments proceeded rapidly, and by the end of the century, governments began to enact legislation to protect the quality of food. Most of the national standards organizations were established in the 1920s, while activity in international standardization intensified within the framework of the ISO in the early 1950s.

A systematic, preventive approach to food safety was promoted with the development of the Hazard Analysis Critical Control Point (HACCP) in 1959, and in 1962, the Codex Alimentarius Commission (CAC) was launched within the Joint FAO/WHO Food Standards Program. Since that time, a more global marketplace, greater consumer awareness, stricter regulations, and a deeper knowledge of potential health risks have only increased the need for reliable, accurate, and comprehensive analyses to support safe and sustainable production across the entire food and beverage chain. We can “trust to taste” with complete analytical solutions for detection, identification, and monitoring provided by the Bruker Corporation.



## **Bruker Optics**

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  - Raman spectroscopy
  - Gas Analysis / Remote Sensing
- [www.bruker.com/optics](http://www.bruker.com/optics)



## **Bruker Daltonics**

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  - LC & GC QqQ with TASQ software
  - MALDI-TOF, MALDI Biotyper
- [www.bruker.com/daltonics](http://www.bruker.com/daltonics)



## **Bruker AXS / Bruker Nano Analytics**

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  - EDXRF Benchtop spectrometer
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## **Bruker BioSpin**

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  - EPR benchtop spectrometer
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- [www.bruker.com/nmr](http://www.bruker.com/nmr)

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