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Food Quality, Regulatory Compliance and Safety
The Role of Analytical Science to Ensure Health and Well-Being

Measurements are important in assessing our food supply for quality, regulatory compliance and safety. From how food feels in our mouths to freedom from unwanted antibiotics and pesticide residues, measurements are what ensure that what we consume is expected and safe. In addition, food safety is a paramount global concern as the level of import and export activity grows and the food supply chain spans the globe.

While it would be impossible to eradicate all concerns, solutions are available to detect and contain harmful food. U.S. legislation such as the 2002 Bioterrorism Act and a 2004 presidential directive require closer scrutiny of ingredient suppliers and tighter controls of manufacturing procedures. There is no global food regulator and no consistent monitoring standard for the food supply. Monitoring is non-routine. In fact, in the U.S., only 1 percent of imports are inspected.

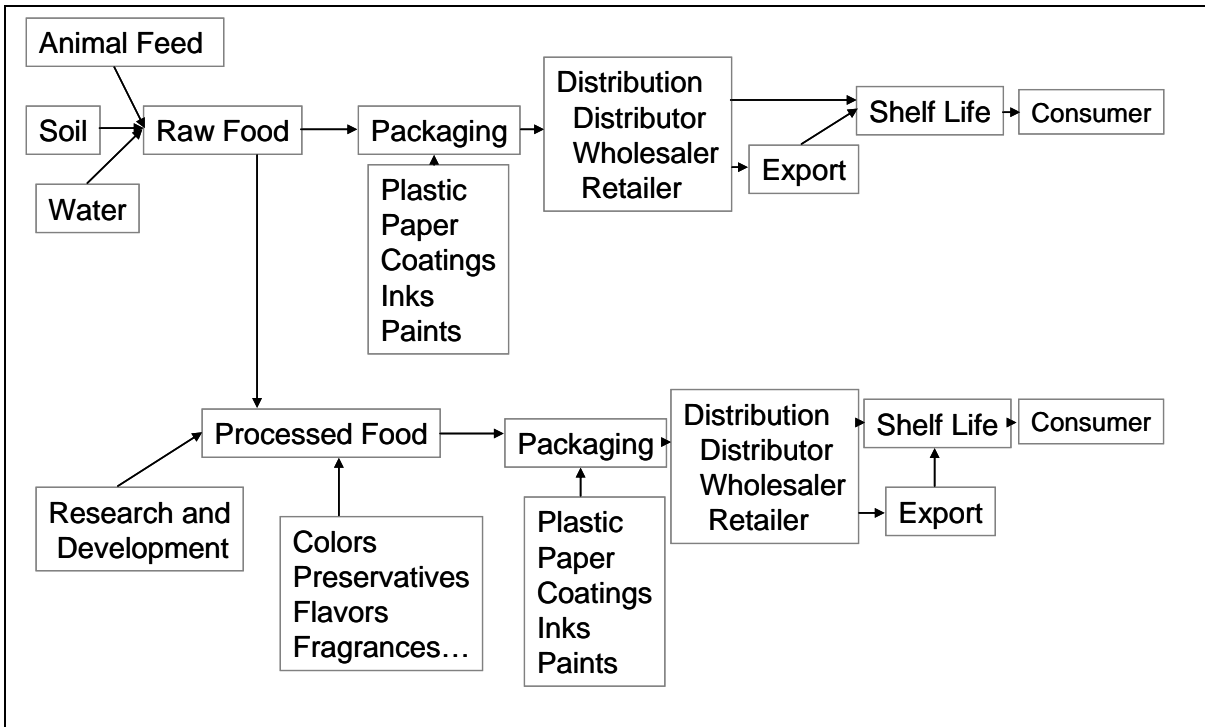


Figure 1. Food Value Chain

Accurate analysis of food for nutritional content, pesticide residues and authenticity is critical for regulatory and quality assurance. Analytical instrumentation providing accuracy, precision, high throughput and rapid delivery of information is vital to ensuring global health and well being. The measurement of contaminants is critically important in determining accidental or intentional addition of foreign chemicals.

A combination of innovative technologies and applications support can help food producers ensure that food and packaging can be tested from the source of ingredients to the final product with a high level of sensitivity and reliability (Figure 1).

A pioneer in the analytical measurements business, PerkinElmer has supported scientists across the world for 70 years in the analysis of the nutritional composition and quality as well as the types and levels of contaminants in foods and beverages. Given the vital importance of the food supply to health and well-being of all living things, food safety is one of the three key focus areas of PerkinElmer's EcoAnalytix™ initiative. EcoAnalytix provides market- and application-focused measurement solutions to enable scientists to unleash their business potential to improve and protect our world.

PerkinElmer solutions are currently used in a myriad of food production and processing environments to test various aspects of safety and quality. Additionally, the company's instruments and systems are employed in the testing of poultry for Avian Flu, pet foods for melamine determination, edible fats and environmental samples for polycyclic aromatic hydrocarbons, traditional Chinese medicine and herbal supplements for trace metal levels. PerkinElmer instrumentation can also test the safety of food packaging.

Food Quality

Food quality refers to a number of different aspects of food, including the freshness, taste, nutritional content, and physical properties, such as the texture and crispness. It might be evaluated in the raw food before further processing or during the development of new processed food products or during food processing. The packaging material might also be evaluated during development to determine its ability to adequately preserve the food for stability and freshness. Examples of the types of analyses and instrumental methods used are as follows:

- Evaluation of the crispness of a potato chip with varying levels of humidity with a dynamic mechanical analyzer (DMA)
- Evaluation of packaging material with a headspace-gas chromatograph (HS-GC) to determine the outgassing of potential organic contaminants
- Evaluation of fats and sugars with GC
- Evaluation of vitamins with Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)

Regulatory Compliance

Regulatory compliance occurs at a number of points along the food chain, including compliance with labeling requirements. Mandatory and voluntary nutrients must be measured to ensure packaging is labeled correctly. The need for indicating compliance with other regulations such as genetically-modified organism (GMO) or possible allergen content will also require analysis.

Counterfeit foods are also an issue only resolved through testing. Is orange juice labeled as being from Florida really from that source? Testing is the only way to be sure. Profiles of authentic juices from different regions have been profiled for their trace metal content and can be compared to unknown juices to determine their source.

Instrumentation used in regulatory compliance includes:

- ICP-OES for evaluation of mandatory nutrients iron, calcium, sodium, and potassium and toxic elements
- ICP-MS for authentication profiles
- GC for measurement of fats and sugars
- DRC™ ICP-MS coupled with HPLC to determine speciated elements in bottled water, such as bromate

Food Safety

Food safety measurements occur throughout the entire food value chain. Critical to ensuring healthy foods, these analyses are performed on raw foods and in the best scenario, at several points in processing, right through distribution. As we have seen from recent news stories, raw foods are not immune to contamination and the water and soil with which the plants/animals/fish are nourished can contribute to undesirable contaminants and pathogens in the final product. In addition pesticide residues from application throughout the growing season may remain at unacceptable levels (or from pesticides banned in the importing country) in the harvested product. Residual antibiotics and metals picked up from the soil may provide undesirable contaminants that can only be detected through measurement in the raw food.

In the United States alone, approximately 15 percent of the food supply and 50 to 60 percent of the fresh fruit is imported. The United States is also a major exporter of raw and processed food products. Given the broad regulatory scrutiny applied to imported/exported food and beverage products, from governments in both the exporting and importing countries, many types of safety and quality analysis are required. These include testing for authenticity and safety, compliance with label claims, and the presence of pesticide residues, conventional contaminants (such as antibiotics), radioactive contaminants, adulterants, and more. Such analyses call for GC/MS, ICP/MS, and Liquid Scintillation Counters (LSC), plus DNA testing and other biological assays.

Pathogens can be introduced at any point through processing and the regulatory requirements for the U.S. Hazard Analysis Critical Control Point have been set in place to provide consideration of this throughout the process. Processed foods are at risk of more than pathogen contamination during processing., The process itself may introduce unexpected contaminants, such as metals and organic chemicals.

Adulterants, added purposefully, usually to prepare a product less expensively, are more difficult to detect because it's not known what compound to examine in the product. General analysis techniques such as ICP-MS and GC/MS are very helpful because they can look for a large number of metals or organic compounds at once and help identify that an unexpected compound has been added.

PerkinElmer's analytical instrumentation used in food safety includes:

- GC//MS for the determination of the type of pesticide and residue amount on raw foods
- ICP-OES for the measurement of metal contamination in raw foods, such as lead (Pb)
- GC/MS analysis of finished products for melamine and related adulterants
- HPLC for the analysis of aflatoxins in nuts, wine and seeds

Such analyses call for a variety of technology solutions such as gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS), High-Performance Liquid Chromatography (HPLC), and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), in addition to Automation and Liquid Handling capabilities.

PerkinElmer understand the laboratory need for productivity and rapid start up. The PerkinElmer EcoAnalytix Initiative is designed to help get you moving quicker with complete application packages. For example, in partnership with the FDA through Flora Research, PerkinElmer was the first to offer a complete turnkey system for the analysis of melamine adulteration in protein-based foods using gas chromatography/mass spectrometry (GC/MS). The Melamine GC/MS Turnkey System includes all instrumentation, consumables and applications resources needed to analyze samples for melamine contamination.

Laboratory Information Management

PerkinElmer's LABWORKS™ LIMS provides unique applications tailored to fit any laboratory's needs. With a history of top-rated customer support and industry-leading LIMS technology, LABWORKS can help throughout the food value chain to manage the business and technical process.

Service and Support

PerkinElmer's 1,200 factory-trained and certified engineers have on average 15 years of experience maintaining leading-edge scientific equipment from predictive and preventative maintenance to validation support, instrument repair and training and technical support. It's the largest and most experienced service force in the industry.

Global service and support are available to assist in any aspect of a lab's analysis, data management or reporting challenges. The company's easy-to-use instruments with local-language capabilities allow ease in instrument set-up and training.

More information

For more information about PerkinElmer's solutions to support food quality and safety visit www.perkinelmer.com/food.