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XRF Elemental Analysis Solutions for Food and Agriculture

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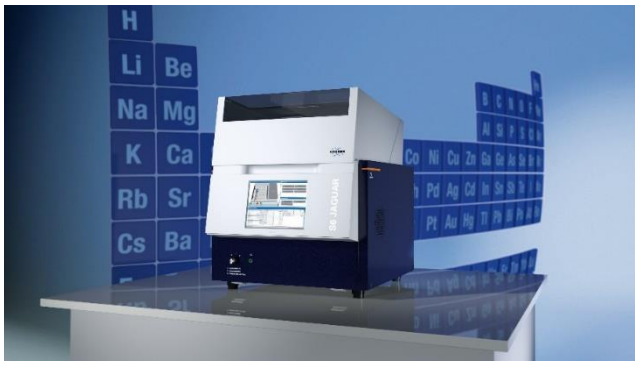
Knowledge about the elemental composition of food and feed products, as well as of the raw materials used in the production process, is critical for meeting modern quality and safety standards.

In many steps of the production process, fast and reliable information about major, minor, and trace elements is required for smooth and cost-efficient production. This makes X-ray fluorescence (XRF) spectrometry the optimal solution for many analytical tasks in the food and feed industry. XRF is a non-destructive technique that can identify and quantify most of the elements in the periodic table (typically, F to U) in almost all raw materials, by-products and finished products, including dairy and formula, premix and forage, pet food, and edible oil. Key benefits of XRF include simple sample preparation, ease-of-use, low cost of operation, and fast time-to-result.

Bruker XRF Analyzers

Total Reflection XRF (TXRF) analyzes materials to the sub-ppb trace level. Micro-XRF visually maps out nutrient density distribution of elements in a material. Lab XRF combines high-throughput and accuracy, allowing users, for example, to quickly identify and verify incoming goods and to perform at-line quality control. Portable XRF systems can be taken to the sample, whether it's at the loading dock, on the production floor, in the green house, or out in the field.



Modern Lab XRF spectrometers are equipped with an XY-Autochanger, allowing high throughput at production facilities.

Food Quality Monitoring

High quality and nutritious food are of primary concern to everyone, from the farm to the table. XRF elemental analysis provides key information to help assure the presence and amount of essential and beneficial nutrients and additives, such as macro- and micro-nutrients. For example, XRF is used to accurately quantify magnesium (Mg), phosphorus (P), potassium (K), and calcium (Ca) in products like cereals, beverages, snacks, and pet foods.

Portable XRF is used to measure mineral nutrients in powdered milk.

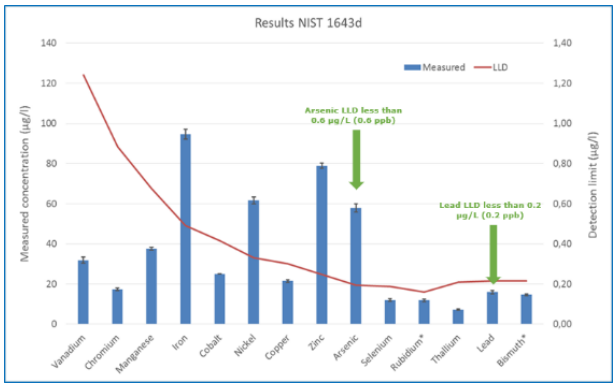
Equally important is XRF's ability to measure additives and fortificants, such as sodium (Na) and iron (Fe), used in food products. Additionally, XRF's ability to monitor critical process indicators is noteworthy. For example, XRF monitoring of P in the production of edible oils is indicative of phosphatide content which determines oil quality and helps monitor the refining process, especially important during the degumming process. Another example is monitoring Al, Fe and Pb levels during the production of cocoa powder to ensure product safety, consistent taste, optimum nutrient content, and to help prevent accidental Fe contamination from processing equipment.

The expense of animal feed and nutrition is a significant operating cost for most commercial livestock producers. To maintain an optimum balance between feed costs and productivity, ingredients are analyzed for macro-, micro- and trace mineral nutrients since these values are essential to formulating the rations and required supplements. Similarly, XRF is used to distinguish nutrient sources in pre-mixes and forages which can vary in mineral concentrations, especially of Ca, K, Mg, Cu, Zn, Co, and Mo.

Energy dispersive XRF is used to quantify macro-, micro- and trace-concentration mineral nutrients.

Food Safety Screening

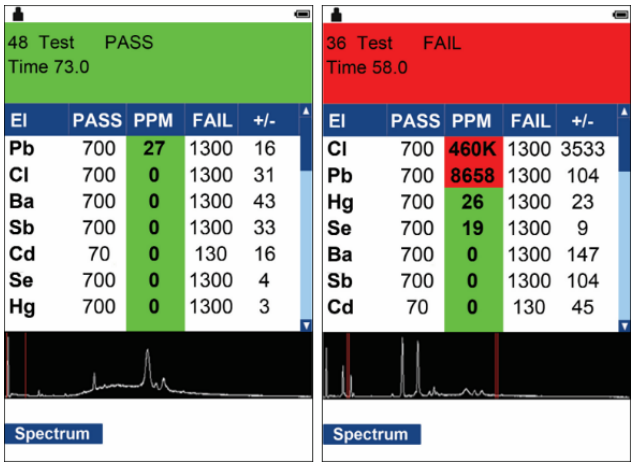
Safe food is also of primary concern to everyone. The recent prevalence of contaminants and adulterated, counterfeit or fraudulent food has led to an increase in public awareness and government



TXRF can identify heavy metals at levels below 1 ppb.

regulations. Although newsworthy cases highlight contaminants at high levels, even low concentration levels can be dangerous.

No manufacturer wants heavy metals or other dangerous elements in their food products. However, such elements can enter production through intentional or incidental adulterants, such as lead (Pb) and chromium (Cr) in colorants or arsenic (As) and bromine (Br) from pesticides. XRF is used to screen raw materials, goods in-process, and finished products prior to final release.



Portable XRF identifies products that pass or fail safety with preset thresholds.

Additionally, no one wants physical contaminants to end up in their products, but it does happen. Consequently, XRF is used to identify foreign materials found, such as metals, ceramics, stone, glass, and plastic, as quickly as possible to decrease the time it takes to locate the contaminant source.

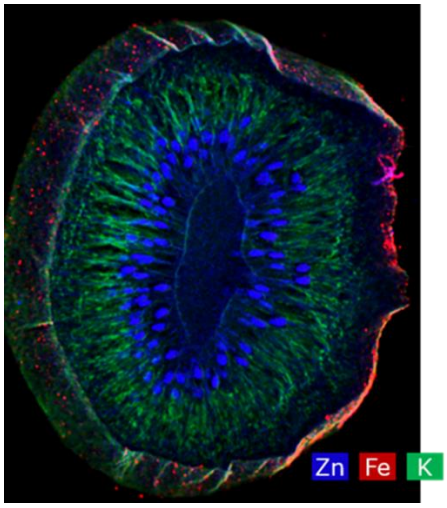
This helps to determine if it's from faulty equipment, starting material, or even a false claim.

Sustainable Agriculture Optimization

Monitoring elemental nutrients and heavy metals with XRF for healthy soil and plants helps achieve the goals of sustainable agriculture. These goals include practices to naturally enhance soil and crop quality, boost the resilience of crops, reduce unnecessary inputs such as excess fertilizers, regain nutrient density of food, and restore the fertility of exhausted soil. XRF is used to perform elemental analysis on the entire plant system, including seeds, soil, irrigants, fertilizers, the root system, and the shoot system.

When you can't take the sample to the lab, you can take the lab to the sample.

XRF is used in the development and identification of biofortified seeds which look to increase levels of elements like Zn and Fe in staple foods without the need for excess fertilizers. XRF is used to characterize soil nutrients in a given location to determine supplemental nutrient needs with site-specific additive blends. XRF is also used to determine the presence of heavy and other toxic metals in the soils or other media prior to its use for crop production. Finally, XRF is used to determine nutrients and/or heavy metals that the plants absorb during their growth.



Micro XRF elemental distribution map of zinc (Zn), iron (Fe), and potassium (K) in a kiwi slice.

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