

A Validated mHD-XRF Approach to Rapid Heavy Metal Screening in Foods

State public health laboratories play a critical role in protecting the food supply, yet traditional analytical approaches such as ICP-MS often limit testing capacity due to cost, complexity, and time per sample.

Dr. Sinisa Urban, Chief of the Division of Environmental Sciences at the Maryland Department of Health, was highly motivated to determine if using monochromatic high-definition x-ray fluorescence (mHD-XRF) could be used to greatly expand his lab's ability to screen retail food and additive samples for heavy metals. Because of the time per test and cost, their previous approach of using ICP-MS limited the number of samples they could test.

Dr. Urban's lab is part of the US FDA LFFM network, a group of high-performance state labs across the US tasked and funded by the FDA to build capacity and capability to detect, identify, and respond to food-borne hazards. In addition to surveillance testing, the network's members are encouraged to develop new testing methods.

Based on preliminary results by Dr. Patrick Parsons (and others), the Maryland State Department of Health purchased both the E-max and Z-max units from Z-Spec, and then subjected them to rigorous testing. Although a manuscript is currently being prepared and is not yet available, his research used 97 real-world spices collected over 14 years in 3 different states and found the detection limit for lead to be 0.028 ppm, with no false positives or false negatives encountered.

FDA evaluated and approved this research as a rigorous single lab validation study (SLV), and the Lab's Assessor approved adding the method to the lab's ISO17025 Scope of Accreditation. With the FDA's encouragement, Dr. Urban prepared a proposal for a multi-lab validation (MLV) study for 4 or 5 additional labs utilizing this method, which is expected to commence in July.

This work demonstrates that mHD-XRF, implemented on Z-Spec E-max and Z-max analyzers, delivers fast, accurate heavy-metal screening with low detection limits across real-world food samples. FDA recognition, ISO 17025 accreditation, and an upcoming multi-lab validation study position mHD-XRF as a scalable, regulatory-ready screening solution for food safety laboratories.

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