

Higher Throughput Analysis of Chemical Residues in Foods

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Monitoring of pesticides, environmental contaminants, veterinary drugs, and other adulterants in food is an important function of regulatory, industrial, contract, and other laboratories worldwide for many purposes. For example, the World Trade Organization reports that global trade of food and agricultural products was \$3.25 trillion in 2015, and exported product must meet the regulatory standards of the importing country, which includes chemical residue limits. Since lives and livelihoods can depend on monitoring results, the analytical methods used must be accurate and valid for a wide scope of ultra-trace contaminants in diverse commodities. Furthermore, the perishability of food items and added cost of analytical testing means that monitoring for chemical residues in foods also needs to be fast and cost-effective. Fortunately, new developments in high-throughput analysis for hundreds of analytes are available to better meet food safety analysis challenges. To start, collected bulk samples can be processed quickly in a way that provides 2-5 g test portions (rather than 10-15 g) for analysis that still represents the original sample. Due to the sample size reduction, the amount of reagents and costs for sample preparation are proportionally lower, and higher sample throughput is attained by extracting more samples in the same batch. Up to 100 samples can be extracted simultaneously in 10 minutes using QuEChERS in 15 mL centrifuge tubes with an inexpensive platform vortex shaker, followed by 3 min centrifugations in batches. This initial extract is split into autosampler vials for 10 min analysis each of hundreds of analytes in parallel using liquid chromatography (LC) and gas chromatography (GC) each coupled with tandem mass spectrometry (MS/MS) detection. In the case of LC-MS/MS, only filtration is needed prior to injection of milligrams of equivalent sample to meet detection limit needs. In the case of GC-MS/MS, automated mini-column solid-phase extraction cleanup is done using a robotic autosampler just prior to injection. Quantification and qualitative identification of the hundreds of targeted analytes on each instrument are accomplished automatically without need for human review using summation integration of chromatographic peaks. This highly streamlined approach will be described for wider implementation by other labs.