

What is more than QuEChERS? The QuEChERSER mega-method for the analysis of pesticides, veterinary drugs, and environmental contaminants

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Since its introduction in 2003, the QuEChERS approach has become widely applied throughout the world for pesticide residue analysis and other applications. However, it is showing its age as improvements in instrumentation, automation, and data quality expectations are made. Also, monitoring programs have an increased need for greater lab efficiency and ever wider scope of analysis to combine veterinary drugs, pesticides, environmental contaminants, and plant and fungal toxins into the same method. Methods used for such wide applicability are known as mega-methods. It is also efficient for validation and other reasons for lab efficiency to use the same sample preparation protocol for all samples and applications even if analytical methods don't necessarily include all the same analytes for all sample types. The target list can be changed easily in LC-MS-, GC-MS-, or SFC-MS-based analyses independent of sample preparation. With this in mind, the QuEChERS was re-evaluated and re-optimized into an improved generic extraction protocol called QuEChERSER, which is also "elegant" and "robust" (or "efficient" and "reproducible"). In the method, 2 g thoroughly comminuted sample, ideally using liquid nitrogen, is extracted with 10 mL of 4/1 (v/v) acetonitrile/water for 10 min by shaking, followed by centrifugation for 3 min. A 200 μ L portion is transferred to a mini-centrifuge tube and quickly evaporated under nitrogen flow, followed by addition of initial LC mobile phase solvent and ultracentrifuged for 5 min before analysis by LC-(HR)MS(/MS). For GC-amenable analytes, the remaining initial extract is decanted into a 15 mL tube containing 2 g of 4/1 (w/w) MgSO₄/NaCl, which is shaken 1 min and centrifuged again for 3 min. Lastly, 1.5 mL of the upper layer is transferred into an autosampler vial, 300 μ L of which undergoes cleanup by micro-solid-phase extraction (u-SPE) using automated Instrument Top Sample Preparation (ITSP), immediately followed by low pressure (LP) GC-(HR)MS(/MS) analysis. ITSP is conducted in parallel with LPGC-(HR)MS(/MS), which is also conducted in parallel with LC-(HR)MS(/MS), with all methods taking <13 min cycle times per sample. The new QuEChERSER mega-method can be used for a narrow or wide scope of analytes and matrices, depending on the application need, rather than using a different method for each application. The elegant, robust, efficient, and reproducible features of QuEChERSER has many advantages over QuEChERS, and is expected to become widely employed in the 2020s and beyond.

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Research:

Since 1992, scientific investigations and method development research have involved improvement in the analysis of pesticides, veterinary drugs, and other contaminants in food and environmental samples. Research has addressed all aspects of the analytical process, including sample processing, preparation, cleanup, separations, detection, screening, quantification, identification/confirmation, and data processing using many types of analytical techniques applied in novel and useful ways.

Education:

Ph.D. Analytical Chemistry (minor in Environmental Sciences),
Dept. of Chemistry, University of Florida, Gainesville, FL, Aug. 1987 - Jan. 1992
B.S. Chemistry, Dept. of Chemistry; University of Florida, Gainesville, FL, Aug. 1983 - May 1987

Selected Awards:

The NACRW George and Wilma Fong Founders Award, 2019
Fellow of the American Chemical Society (ACS), 2019
The Analytical Scientist Power List Top 10 Public Defender, 2017
ACS-AGRO Fellow, 2017
NACRW Excellence Award in Sample Preparation (shared), 2015
USDA Secretary's Honor Award (shared), 2014
North Atlantic Area Senior Research Scientist of the Year, 2014
Clarivate Analytics (Thomson Reuters) Highly Cited Researcher, 2014-present
ACS Division of Agrochemicals Award for Innovation in Chemistry of Agriculture, 2012
Journal of Chromatography A Top Cited Article 2010-2011 (shared), 2012
AOAC International Harvey W. Wiley Award, 2011

**Author of >160 scientific articles plus >235 abstracts.
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