

ADDRESSING THE CHALLENGE OF SMALL MOLECULE SEPARATION IN COMPLEX SAMPLES THROUGH SUSTAINABLE AND HIGH-THROUGHPUT MICROEXTRACTION TECHNIQUES. **Emanuela Gionfriddo**, University at Buffalo, the State University of New York, Department of Chemistry, 369 Natural Science Complex, Buffalo, NY 14260-3000, USA. (egionfri@buffalo.edu)

The extraction of small molecules from complex samples presents a significant challenge in analytical method development, whether for targeted or non-targeted analysis. Recent trends in microextraction techniques development have shifted towards greener and faster approaches, ensuring sustainability and high throughput during the extraction process. Solid Phase Microextraction (SPME) is an ideal method that aligns with these features, offering simultaneous extraction and enrichment of targeted analytes. We explore novel microextraction methodologies to investigate the chemical composition of environmental and biological samples and assess the partitioning of small molecules in heterogeneous systems. Our work specifically targets various classes of environmental contaminants, such as PFAS, pesticides, and pharmaceuticals. We have developed specialized extraction technologies to ensure selective extraction and preconcentration of these compounds from complex samples before subjecting them to gas or liquid chromatography and direct introduction to mass spectrometry. These methods play a critical role in evaluating pollutants' environmental mobility and their impact on living systems. Additionally, we investigate the use of biocompatible extraction phases and alternative SPME geometries to address specific analytical needs while minimizing disturbances to partition equilibria during the extraction process. These advancements hold promise for improving the accuracy and efficiency of small molecule analysis in complex sample matrices.