

## Green and Sustainable Analytical Chemistry

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The pursuit of sustainability has become a central tenet of modern analytical chemistry, challenging researchers to rethink traditional methodologies. Green Analytical Chemistry (GAC), articulated through twelve guiding principles, provides a foundational framework for minimizing the environmental impact of analytical processes. However, the first principle recommending to eliminate sample preparation step has been misinterpreted, fostering the misconception that its omission is inherently green. This talk introduces the concept of Green Sample Preparation (GSP) and its ten core principles, offering a roadmap to integrate environmental responsibility into this critical step of the analytical workflow. Emphasis is placed on safe, renewable, and reusable materials, waste and energy minimization, miniaturization, automation, and operator safety. The presentation will include AGREEprep, the first dedicated green metric tool for evaluating and improving the sustainability of sample preparation protocols.

Building on this foundation, the concept of Circular Analytical Chemistry will be presented. Defined through twelve strategic goals, it envisions a future where analytical performance is decoupled from resource consumption. Circular Analytical Chemistry emphasizes lifecycle thinking, closed-loop systems, and the integration of circular economy principles across the entire analytical process.

Finally, the talk will critically examine prevailing myths in sustainable analytical chemistry, including the overuse of vague “green” labels and narrowly applied metrics. It will highlight transformative advances, such as greener solvent selection, energy efficiency, and circularity, and underscore the importance of addressing the social and economic dimensions of sustainability.

Short bio: Eleftheria (Elia) Psillakis is Full Professor in Water Chemistry at the School of Chemical and Environmental Engineering, Technical University of Crete. She received her degree in Chemistry from Université Montpellier II, France with Summa Cum Laude, and her PhD from the University of Bristol, U.K. In 2007, she received a Fulbright Award and used it at Caltech, USA. Her research activities focus on (i) studying the presence and photolytic fate of emerging pollutants in natural and engineered systems, (ii) advancing the concepts of green and sustainable analytical chemistry, and (iii) the fundamentals and development of novel sample preparation methods. In 2025, Professor Psillakis was awarded the Silver Jubilee Medal from The Chromatographic Society, and in 2021 she featured in the Power List of the magazine “The Analytical Scientist” as one of the Top 100 most influential people in analytical science. To date, her investigations have resulted in six book chapters more than 100 publications in ISI Journals, with > 10000 citations (h-index=52) and six “Top cited article” awards. She is Editor-in-Chief of “Advances in Sample Preparation”, Elsevier (Q1 Journal with IF=5.2), Specialty Chief Editor of “Environmental Analysis”, Frontiers in Analytical Science (Frontiers) and served as an Associate Editor of the “Journal of Separation Science” (Wiley). Professor Psillakis is also Head of the Sample Preparation Study Group and Network of the European Chemical Society-Division of Analytical Chemistry (EuChemS-DAC), elected member of EuChemS-DAC, and Affiliate Member of IUPAC. She is the Founder of ExtraTECH Analytical Solutions, a Spin-Off Company of the TUCrete. From 2014-2016, she was the Deputy Rector of Academic Affairs and Research at the Technical University of Crete and has served twice as Director of postgraduate studies.