Benefits of supercritical fluids for the extraction, analysis and purification of synthetic and natural molecules

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Supercritical fluids have been in regular use to extract, analyze and purify chemicals and natural products for a few decades. While several different fluids had been explored in the past, supercritical CO_2 is now the preferred one, because it has many desirable features: low price, low toxicity, low reactivity, easily-reached critical conditions and good recyclability making it fit for sustainable development.

Thanks to these qualities, supercritical fluid extraction (SFE) and supercritical fluid chromatography (SFC) have both seen a significant surge of interest in the past ten years, especially thanks to recent instrument developments. Significant improvements were made, particularly to enhance the sensitivity and robustness, which have made it possible to consider SFC in quality control laboratories. In addition, facilitated hyphenation to mass spectrometry (MS) to improve detection capabilities is opening the way to new applications. Indeed, analytical SFC is now used both for achiral and chiral separations, and for increasingly polar compounds.

In this presentation, I will explain the fundamentals and illustrate the interest of both techniques with several examples related to drug discovery, cosmetics or natural products. I will particularly highlight the differences between SFC and other, better established techniques like gas chromatography (GC) or liquid chromatography (LC). I will also show the interest of an easy transfer from analytical-scale to preparative-scale.