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Supercritical Fluid Chromatography (SFC) interfaced to cold electrospray MS (and other common detectors), the next, go there first, analytical technique? ...and it's green too?

In our work in pharma, we use UV, ELSD, and/or MS detection for many tens of thousands of analyses per year, and frequently, all 3 of these detection approaches are used simultaneously with each chromatographic instrument. At the same time, we have great need to focus on the polar parts of the molecules to achieve sufficient separation. Often reversed phase (RP) separations are insufficient when the polar part of the molecules is the focus. Normal phase (NP) LC can achieve sufficient separations, but tends to be slow, intolerant of high sample loading, and not readily interfaced to MS. In contrast, using CO₂ as a solvent (SFC) is fast, green, facilitates much easier method development, and tolerates a greater range of sample load than NP-LC while generally delivering the same or better NP separation.

While SFC has been long used with a variety of LC detectors, the performance of these detectors with SFC has generally been notably lower than commonly achieved with LC. This is particularly true for MS detection. Clearly, more progress is needed in adapting SFC to the more common LC detection approaches. This has led us to study the interfacing of each of these detectors to SFC individually and in combined set ups with split flows in order to achieve optimal separations (SFC) and detection (MS, ELSD, & UV) simultaneously. The outcome of the study for detector performance is that essentially identical detector performance can be achieved with SFC as is observed with RP-LC, even when using cold ESI-MS. These principles are explained and demonstrated for high sensitivity SFC bioanalysis using cold ESI-MS/MS detection as well as Open Access SFC/MS also incorporating UV and ELSD detection.

Our findings are that SFC (w/ UV, ELSD, and/or MS) is not only applicable to polar and/or chiral compounds, but also a broad logP range of analytes where RP-LC is commonly used across many business needs. In this large middle range of compounds (>80% of analytes), SFC provides identical results to LC (except reverse elution order). Thus, it is feasible to shift LC analyses to SFC and achieve a green result: a 75% reduction in solvent waste. We have demonstrated this by shifting 1000s of RP-LC samples to SFC to meet timeline and capacity needs..

Biography

Mark J. Hayward has done his BS Chemistry, Physics, Mathematics, and Computer Science-Univ of West Georgia Ph.D Analytical Chemistry and Chemical Engineering-Purdue Univ Classically trained chromatographer and mass spectrometrist, practicing for 3 decades Built and managed significant analytical and bioanalytical labs at Wyeth, Novartis, and Lundbeck Currently working as a consultant to build new labs and address some the most challenging technical problem in the chemical, consumer products, clinical diagnostic and pharma industries Well known for giving back to the scientific community through collaboration, teaching, and engagement in the interactive dissemination of best practices within scientific societies and at scientific conferences.

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