

Exploring the Feasibility of Employing Supercritical Fluid Chromatography (SFC)-UV-MS for Qualitative and Quantitative Analysis of Fat Soluble Vitamins in Dietary Supplements

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Introduction

Vitamins are biologically active compounds required for an organism's normal health and growth. While the required dose of vitamins is typically obtained through a balanced diet, additional vitamins, if necessary, can be obtained through various dietary supplements. The level of vitamins in food or supplements may be as low as a few micrograms per 100 g. Vitamins are also often accompanied by an excess of compounds with similar chemical properties. With increased regulation for supplement labelling (Title 21 CFR Part 101), it is therefore important to have robust and sensitive methods to not only quantify, but also to identify the vitamins in food and supplements.

Due to their limited solubility in water, fat-soluble vitamins are conceivably more amenable to normal phase liquid chromatography (NPLC); although there have been a few reports on using reversed phase LC for the analyses of fat-soluble vitamins [1]. However, the coupling of NPLC with mass spectrometer (MS), which is typically required for identifying compounds in complicated matrices, is limited by the choices of solvents due to their in-compatibility with MS.

To this end, supercritical fluid chromatography (SFC) provides an attractive alternative. In general, samples are dissolved in methanol or a less polar organic solvent for SFC analyses, which aligns well with the solvents used in the isolation and extraction of fat-soluble vitamins from food and supplements. SFC MS has proven a powerful hyphenated technique for a wide array of applications [2].

Furthermore, with the advancements in SFC performance on detection sensitivity, especially with photo diode array (PDA) detector, comparable limit-of-detection (LOD) and limit-of-quantification (LOQ) to LC can be attained with relative ease, which can potentially eliminate the time-consuming pre-concentration step in sample work-up.

In this application note, we report our case study of using SFC-UV-MS for the qualitative and quantitative analyses of fat-soluble vitamin A palmitate in Enfamil®, Snapple® vitamin-enriched water and Airborne® effervescent tablets, representing three different types of formulations: suspension, liquid and solid.



SFC-MS Resolution II

Experimental

The experiments and results can be found at www.TharSFC.com

Conclusions

SFC-UV-MS provides an alternative to LC for the qualitative and quantitative analysis of fat-soluble vitamins in food and dietary supplements. With SFC APCI MS, a total of 7 (out of 9) vitamins in the Enfamil® were correctly identified. The implementation of reference wavelength compensation and resulting improvement in SFC UV detection sensitivity enabled simple sample work-up for fast and accurate quantitative analyses of fat-soluble vitamins in Snapple® water and Airborne® effervescent tablets, without any pre-concentration steps. The methodology described herein should have wide implications in trace analysis in food, beverage and dietary supplements.

References

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2. R. Chen, Chromatography, 2(1) (2009), 11-13
3. L. Subbarao, J. Cole, R. Chen, LC GC, The Application Notebook September (2009) 50-51