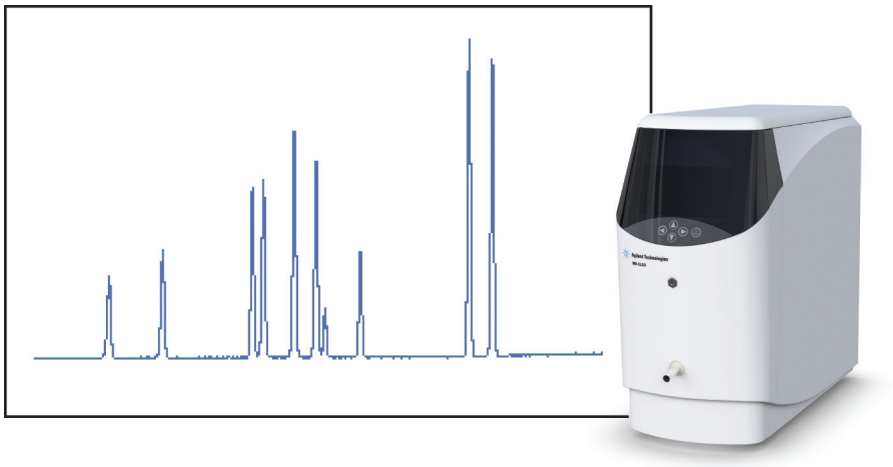
Analysis of herbicides using HPLC with low temperature evaporative light scattering detection

Application Note

Environmental, specialty chemicals, consumer products



Author

Stephen Ball
Agilent Technologies, Inc.
Craven Arms, UK

Abstract

This Application Note describes how the Agilent 380-ELSD Evaporative Light Scattering Detector was used to determine the effect of varying the evaporation temperature during the analysis of a mixture of herbicides with different volatilities. Phenylurea compounds are used extensively in agriculture as selective herbicides, however they are thermally unstable and degrade rapidly to isocyanates and amines, making analysis and detection difficult. The 380-ELSD provides a solution to the problems associated with detection of thermally sensitive compounds because it is designed to evaporate highly aqueous mobile phases at ambient temperature.

Agilent Technologies

Introduction

Phenylurea compounds are used extensively in agriculture as selective herbicides, for pre and postemergence, by inhibiting photosynthesis. They are easily taken up from soil solution by the root systems of plants and rapidly translocated into stems and leaves by the transpiration system. Common phenylurea herbicides, such as diuron, have a relatively low tendency to adsorb to soils and sediments, while its degradation products have a relatively long lifetime. Consequently, the mobility and relative persistence of these herbicides increases the chance of migration to ground water through leaching and surface run-off. Developing analytical methods for the analysis of phenylurea herbicides and their metabolites in surface and ground water is vital to the understanding of herbicide fate and degradation pathways in the environment.

Unlike the majority of pesticides, the application of gas chromatography (GC) to the analysis of phenylurea herbicides is difficult because they are thermally unstable and degrade rapidly to isocyanates and amines[1]. In addition, thermal reactions in the GC column and detector result in a lack of reproducibility, preventing the quantitative screening of the degradation products. A better approach for thermally sensitive compounds is to use HPLC coupled with evaporative light scattering (ELS) detection.

ELS detectors respond to all compounds that are less volatile than the mobile phase. In the past, high operating temperatures were required to fully evaporate aqueous eluents, making the detection of semivolatile analytes difficult or even impossible.

The Agilent 380-ELSD Evaporative Light Scattering Detector is designed to evaporate highly aqueous mobile phases at ambient temperature. This is achieved by introducing a stream of dry nitrogen during the evaporation stage, which increases the vapor loading capacity of the surrounding gas and enables complete evaporation of the eluent to take place without raising the temperature. The advantage of characterizing samples at ambient temperature is demonstrated by the analysis of a mixture of 10 phenylurea herbicides.

Experimental

Instrumentation

Column:	C18, 250 × 4.6 mm, 5 µm
Detection:	Agilent 380-ELSD Evaporative Light Scattering Detector
Nebulizer temp:	25 °C
Evaporation temp:	as given in Figure 1
Gas flow:	1.6 SLM

Materials and reagents

Eluent A:	Water
Eluent B:	Acetonitrile

Sample preparation

Sample:	Phenylurea herbicide mixture

Conditions

Flow Rate:	0.7 mL/min
Injection Volume:	20 µL
Gradient:	10–80% B in 40 min

Results and Discussion

The herbicide mixture contains compounds of different volatilities and the highly volatile herbicides are not detected as the evaporation temperature is increased. Only seven of the 10 herbicides are detected at 70 °C, compared to all 10 at 25 °C. Therefore, by operating the Agilent 380-ELSD Evaporative Light Scattering Detector at ambient temperature the loss of semivolatile components is minimized, the sample integrity is preserved and maximum sensitivity is achieved, as shown in Figure 1.

Conclusion

Separation and identification of semivolatile compounds is straightforward using evaporative light scattering detection at the ambient temperatures that are possible with the Agilent 380-ELSD Evaporative Light Scattering Detector. The 380-ELSD surpasses other ELS detectors for low temperature HPLC applications with semivolatile compounds. Its innovative design represents the next generation of ELS detection technology, providing optimum performance across a diverse range of HPLC applications. The unique gas control of the 380-ELSD facilitates evaporation of high boiling solvents at very low temperatures. For example, 100 % water at a flow rate of 5 mL/min can be removed at 30 °C. The novel design of the 380-ELSD achieves superior performance compared to detectors from other vendors for the analysis of semivolatile compounds.

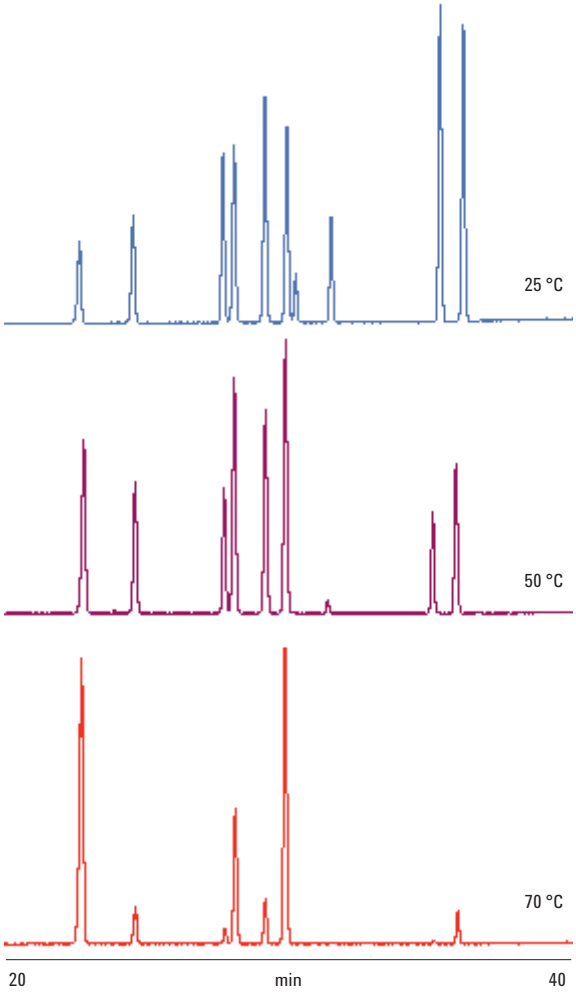


Figure 1
Agilent 380-ELSD Evaporative Light Scattering Detector reveals the presence of semivolatile herbicides when operated at ambient temperature.

Reference

1. S.M. Garland *et al.*, Practical approaches to the analyses for pesticide residues in essential oils, Rural Industries Research and Development Corporation, Barton, ACT, Australia, **2004**.

www.agilent.com/chem/elsd

Published in the USA, January 1, 2012
5990-8839EN

Agilent Technologies