



Efficient Analysis of Biodiesel by HPLC and ELSD

Stephen Bullock
Polymer Laboratories, now a part of Varian, Inc.

Introduction

Interest in biodiesels has increased over recent years due to their environmental benefits. Biodiesel is a renewable fuel composed of methyl esters of fatty acids that can be produced from almost any vegetable oil, animal fat, or used cooking oil. It has similar properties to ordinary diesel and can be used in conventional diesel engines. Crops such as sunflower and rapeseed are the preferred source for producing quality biodiesels, as biodiesels made from waste products such as used cooking oils and animal fat require more processing, via transesterification, before they are suitable for use.

Biodiesels contain complex mixtures of fatty acids, lipids and esters, all of which possess a weak or no UV chromophore. Consequently, fatty acids and lipids are often derivatized to enhance their UV absorbance or to facilitate their detection by GC/MS. Such an approach is time-consuming and difficult to apply to complex mixtures.

Evaporative light scattering detection (ELSD) provides a beneficial alternative for the analysis of biodiesels, because it is capable of detecting any compound that is less volatile than the mobile phase, and is not dependent on the optical properties of the analyte. ELSD also removes the need to derivatize fatty acids and lipids, thus increasing sample throughput. Unlike UV and RI detection, ELSD is fully gradient compatible, displaying excellent baseline stability. This is a key advantage when analyzing such complex samples as biodiesel, because gradient elution is necessary to achieve the desired separation and resolution. ELSD as offered by the Varian ELS detector can be used to determine the composition of vegetable oil-based biodiesels that is of paramount importance within the petroleum industry. The chemical composition of the starting material determines the quality and properties of the resulting biodiesel.

Instrumentation

Column: Silica 3 μm , 250 x 4.6 mm
Detection: Varian ELSD (neb=40 °C, evap=90 °C, gas= 0.8 SLM)

Materials and Reagents

Eluent A: 0.4 % Acetic acid in hexane
Eluent B: 0.4 % Acetic acid in methyl tert-butyl ether (MTBE)

Conditions

Flow Rate: 1.0 mL/min
Injection Volume: 20 μL
Gradient: 100 % A hold 5 min; 0–80 % B 10 min (hold 2 min); 80–0 % B in 3 min

Results and Discussion

Biodiesels from different sources can differ in their fatty acid composition, as highlighted in Figure 1, which shows plots of two biodiesels from different sources of vegetable oil. Animal fats can contain large amounts of free fatty acids that cannot be converted to biodiesel by transesterification, due to the formation of soaps that prevent separation of the biodiesel from glycerine.

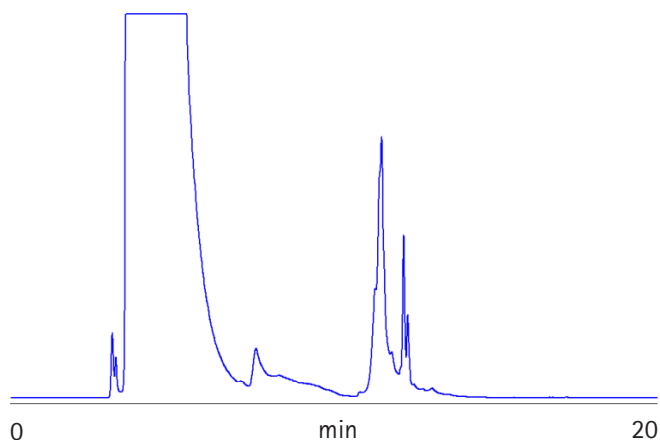


Figure 1a. HPLC separation of two vegetable oil-based biodiesels making use of the full gradient compatibility of Varian ELSD.

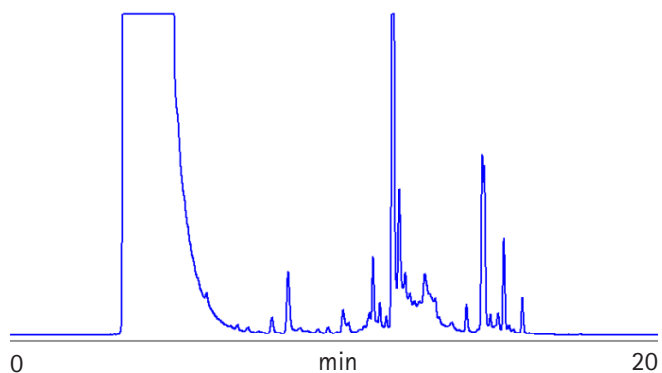


Figure 1b. HPLC separation of two vegetable oil-based biodiesels making use of the full gradient compatibility of the Varian ELSD.

Conclusion

The Varian ELSD provides sample information in a single chromatogram, offering a fast and reliable means of determining the quality and properties of biodiesel due to its superior gradient compatibility. The Varian ELSD surpasses other ELSDs for low temperature HPLC applications with semi-volatile compounds. Its innovative design represents the next generation of ELSD technology, providing optimum performance across a diverse range of HPLC applications. The Varian ELSD's unique gas control permits 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 Varian ELSD provides superior performance compared to detectors from other vendors for the analysis of semi-volatile compounds.

These data represent typical results. For further information, contact your local Varian Sales Office.

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www.varianinc.com

North America: 800.926.3000 – 925.939.2400

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