Analysis of FAME and TG in biodiesel fuel with the Agilent 1200 Series HPLC system

Application Note

Biofuels and Alternative Energy

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Abstract

Biodiesel is a motor or heating fuel produced from renewable vegetable oils or animal fats. With the high cost and limited availability of crude oil, renewable fuels like biodiesel are seen as a way to replace, supplement, or extend traditional petroleum fuels. Biodiesel is produced by a process called transesterification. The vegetable oil is reacted with methanol in the presence of a catalyst to produce a mixture of fatty acid methyl esters (FAME) and glycerin. After removal of the glycerin and other contaminants, the remaining FAME mixture is pure biodiesel. Depending on the oil source, a typical biodiesel contains FAME mixtures having both saturated and unsaturated carbon chains from C_8 to C_{24}.

In this Application Note an exemplary analysis of the concentration of FAME and triglycerides (TG) in biodiesel fuel (diesel oil) is shown. To establish calibration curves, methyl stearate was used as a reference compound for FAME concentration and trilinolein for TG concentration.

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Configuration

Agilent 1200 Series HPLC system

- Agilent 1200 Series Isocratic Pump (G1310A)
- Agilent 1200 Series Standard Autosampler (G1329A)
- Agilent 1200 Series Thermostatted Column Compartment (G1316A)
- Agilent 1200 Series Refractive Index Detector (RID) (G1362A)

A chromatogram of the reference solutions is shown in Figure 1. Figure 2 is an enlargement of the chromatogram shown in Figure 1. The retention time of methyl stearate (3.845 min) and the resolution of methyl stearate and trilinolein (10.54) met column performance criteria. Each of the solutions used for the calibration curves (Table 1) was analyzed twice. The calibration curves were obtained by plotting the concentration (1µg/10 µL) values (x) and the average surface area values (y) for each component (Figure 3 and Figure 4).

Analytical Conditions

Column:	Agilent ZORBAX Rx-SIL 4.6 mm × 250 mm, 5 µm
Mobile phase:	Hexane/2-propanol = 99.6:0.4
Flow rate:	1.0 mL/min
Column temperature:	40 °C
Injection volume:	5 µL

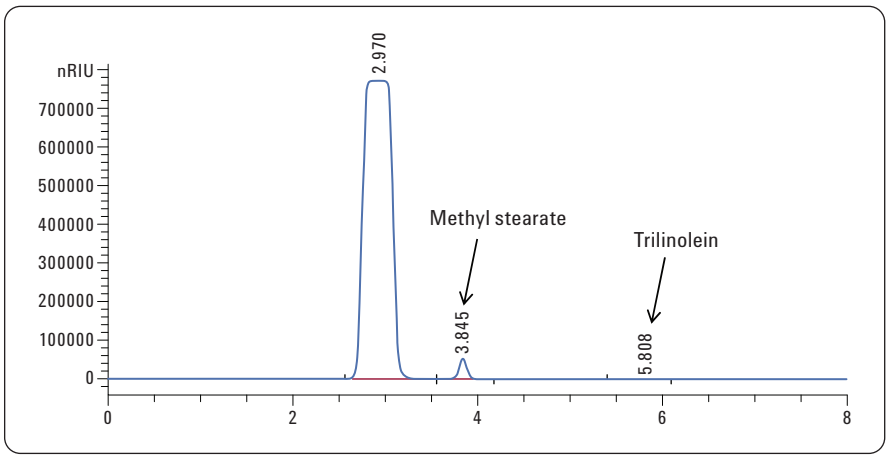

Figure 1
Exemplary analysis of reference compounds (methyl stearate: 100 µg/10 µL; trilinolein: 1 µg/10 µL).

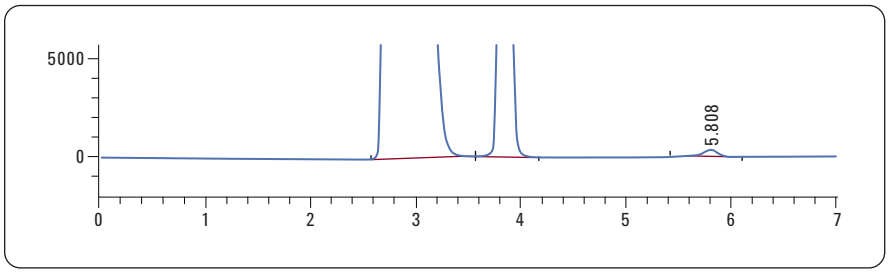

Figure 2
Enlarged Figure 1

Column performance		Figure 1 Results
Methyl stearate retention time	3.5 or more	3.845
Methyl stearate and trilinolein resolution	3 or more	10.54

Calibration curve solutions	Methyl stearat	Trilinolein
1	10	–
2	100	1
3	200	2
4	500	5
5 (undiluted)	1000	10

Table 1
Concentration of calibration curve solutions.

Conclusion

Since triglyceride in biodiesel fuel should be trace level, high sensitive analysis is required.

The Agilent 1200 Series LC system with a refractive index detector can detect small amount of Triglyceride (Quantification limit is 1 µg/10 µL) because of good baseline stability and low baseline noise.

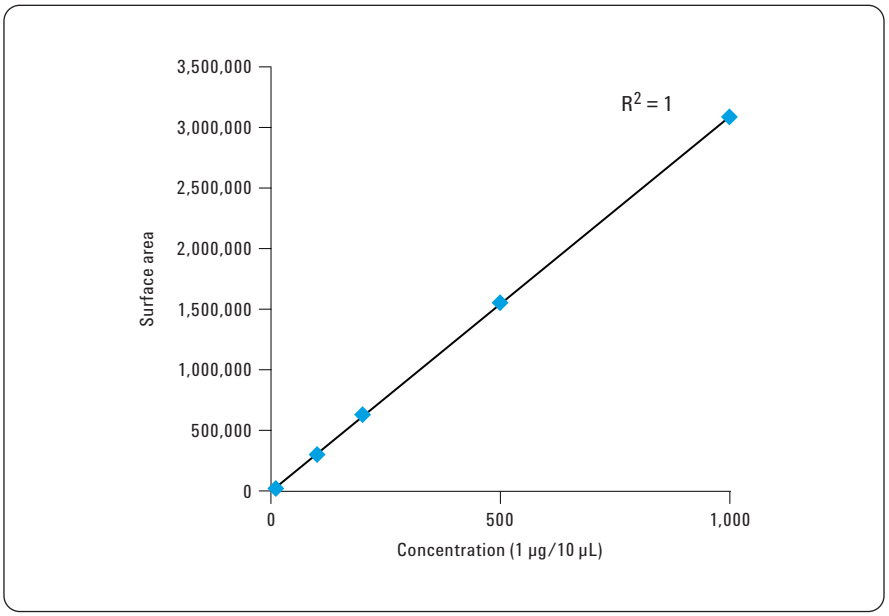

Figure 3
Methyl stearate calibration curve.

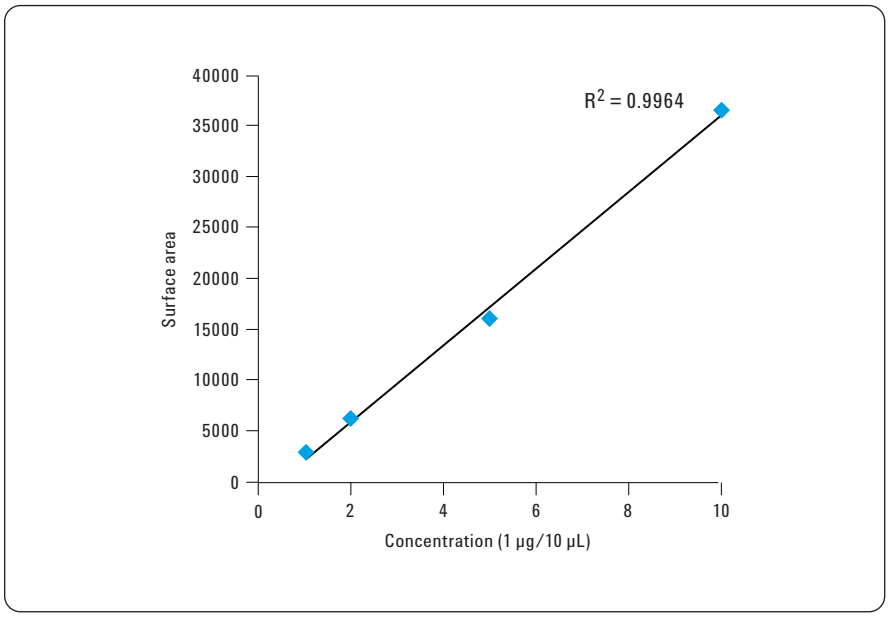

Figure 4
Trilinolein calibration curve.

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