

DVLS Biodiesel Analyzers determine FAMEs according to ASTM D6584, EN 14103, EN 14105, EN 14110 & EN 15779

Introduction

Refiners add biofuel to regular diesel and gasoline fuels to comply with the EU regulations for renewable fuels. Biodiesel is produced by converting vegetable oils or animal fats into fatty acid methyl esters (or FAMEs) in a two-step process. As both steps are equilibrium reactions, there is no complete conversion. Therefore it is essential to purify the fatty acid methyl esters as any remaining glycerides could clog up the engine and cause additional soot when burned. Methanol is an undesirable byproduct, because it is toxic and could lead to the emission of harmful aldehydes. To check biodiesel for any glycerides and methanol content there are various analysis methods available. Da Vinci Laboratory Solutions offers several applications for a Biodiesel analysis that comply with these methods.

Application Range

Table One lists the standard test methods to check the biodiesel for the glycerides and/or methanol content:

Method	Analysis of
ASTM D6584	Total Monoglycerides, Total Diglycerides, Total Triglycerides and Free & Total Glycerin in B-100 Biodiesel Methyl Esters by Gas Chromatography
EN 14103	The ester content in fatty acid methyl esters (FAME) intended for incorporation into diesel oil. It also allows determining the linolenic acid methyl ester content.
EN14105	The free and total glycerol and mono-, di-, triglyceride contents
EN 14110	The methanol content of fatty acid methyl esters (FAME) for use as a diesel fuel and domestic heating fuel.
EN15779	The polyunsaturated (≥ 4 double bonds) fatty acid (PUFA) methyl esters content of fatty acid methyl ester (FAME) as a whole

Table One: The Standard Test Methods for Biodiesel



Figure One: DVLS Biodiesel Analyzer

Flexible Configuration

The DVLS Biodiesel analyzers are based upon the Agilent 8860 or 8890 gas chromatograph (GC) with built-in intelligence and electronic pneumatic control (EPC).

The analyzers are dedicated to the following applications:

1. EN 14110
2. EN14103 & EN 15779
3. EN 14105 & ASTM D6584

DVLS Biodiesel Analyzers

The configuration of the Biodiesel Analyzers offers you a high flexibility. Select from the following configuration options to fully meet your requirements:

- Three separate GC's for a maximum sample throughput. Each GC is dedicated to one application;
- Two separate GC's consisting of two or three channels. Each channel is dedicated to one application.

Depending on the required application the GC is equipped with:

- Agilent Automatic Liquid Sampler;
- Automatic or Manual Head Space Sampler for sample introduction of Methanol;
- Flame Ionization Detector(s) with high scanning rate;
- Split/Splitless injection port(s) or cool-on column injection port(s);
- Analytical column(s) for a dedicated analysis.

High level of automation

Data acquisition, instrument control and integration are performed with the Agilent ChemStation, EZChrom or OpenLab software.

The DVLS PetroReporter software automates chromatographic data processing & reporting of the biodiesel applications:

- EN14103: ester content of FAME
- EN15779: Polyunsaturated fatty acid methyl esters (PUFA) content of FAME
- EN: 16300: Iodine number calculation
- Cetane number

Figure Five shows an example of the report generated with DVLS PetroReporter, which includes the Iodine number and Cetane number.

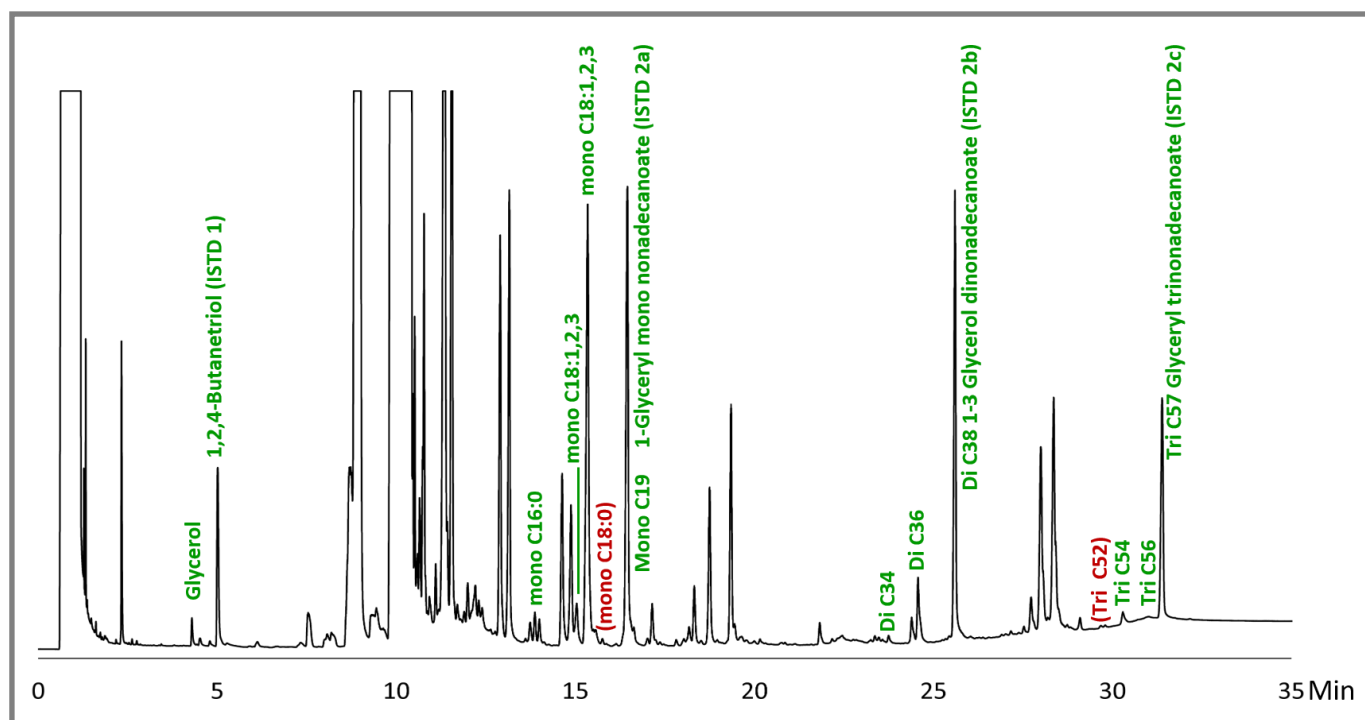


Figure Two: EN 14105 Analysis by the DVLS Biodiesel Analyzer

EN 14110 Analysis

The sample is heated at 80 °C in a hermetically sealed vial to allow desorption of the contained Methanol into the gas phase. When the equilibrium is reached, a defined part of the gas phase is injected into a GC. Methanol is detected with a Flame Ionization Detector. Normally Methanol is the only peak in the chromatogram. The amount of Methanol is calculated by reference to an external calibration.

EN14103 & EN 15779 Analysis

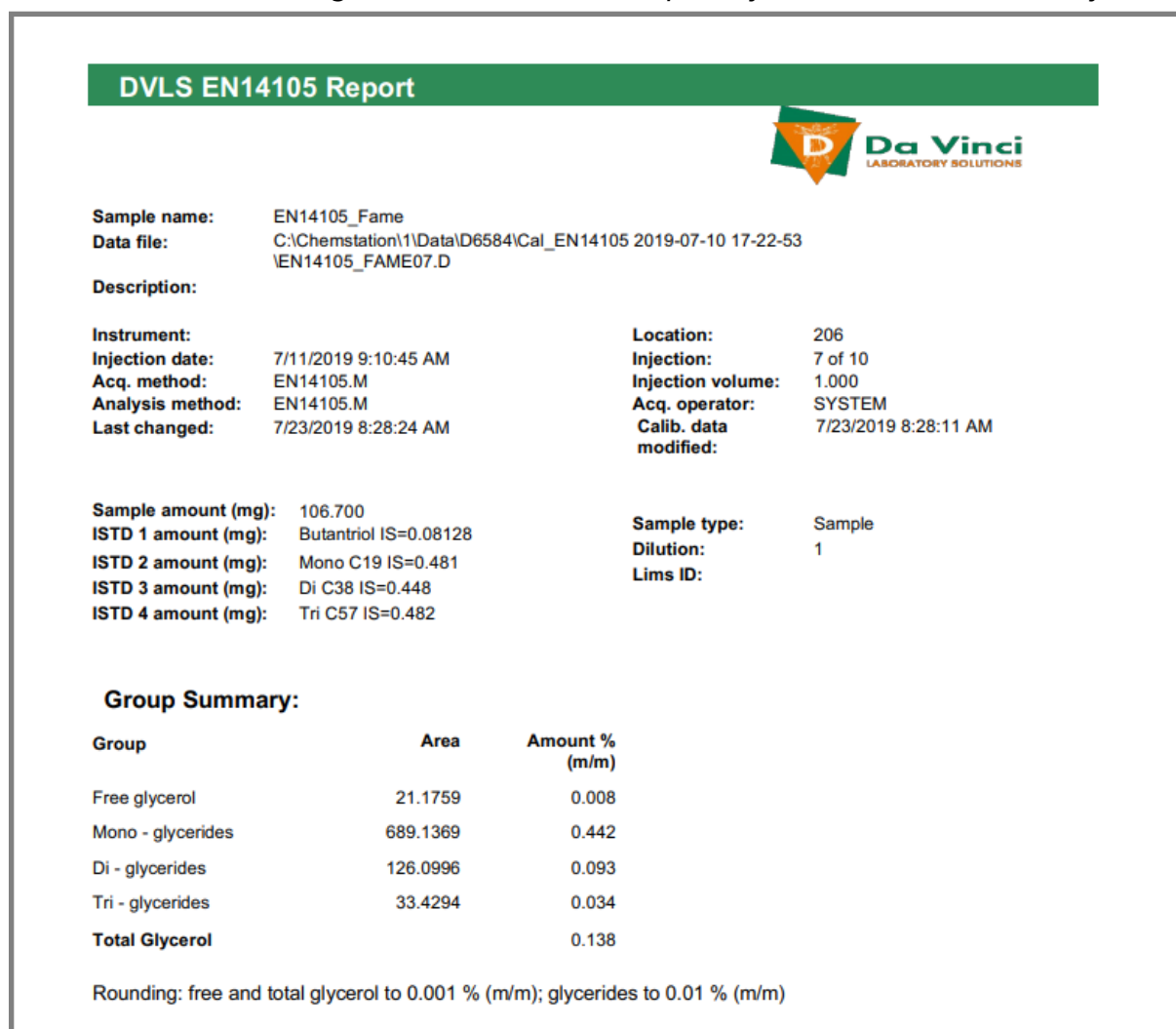
The automatic liquid sampler injects the sample into a Split/Splitless (S/SL) inlet. The polar stationary phase separates the FAME into its individual components. The components are measured by Flame Ionization Detection. Quantification is performed using internal calibration with nonadecanoic acid methyl ester (C19:0) as internal standard. Toluene is used as solvent.

EN 14105 & ASTM D6584 Analysis

The glycerol and of the mono- and diglycerides are transformed into more volatile and stable silyl derivatives in presence of Pyridine and N-methyl-N-trimethyl-silyl-trifluoroacetamide (MSTFA).

After the reaction of the sample with MSTFA, the automatic liquid sampler injects the sample into a cool on-column (COC) inlet. Four internal standards are added to the sample to quantify the free, mono, di and triglycerides individually. The compounds are separated using the analytical column and measured by Flame Ionization Detection (FID).

Figure Three: EN 14105 Report by the DVLS Biodiesel Analyzer



DVLS Biodiesel Analyzer determines FAMES

according to D6584 & EN 14105, EN 14103, EN 14110 & EN 15779

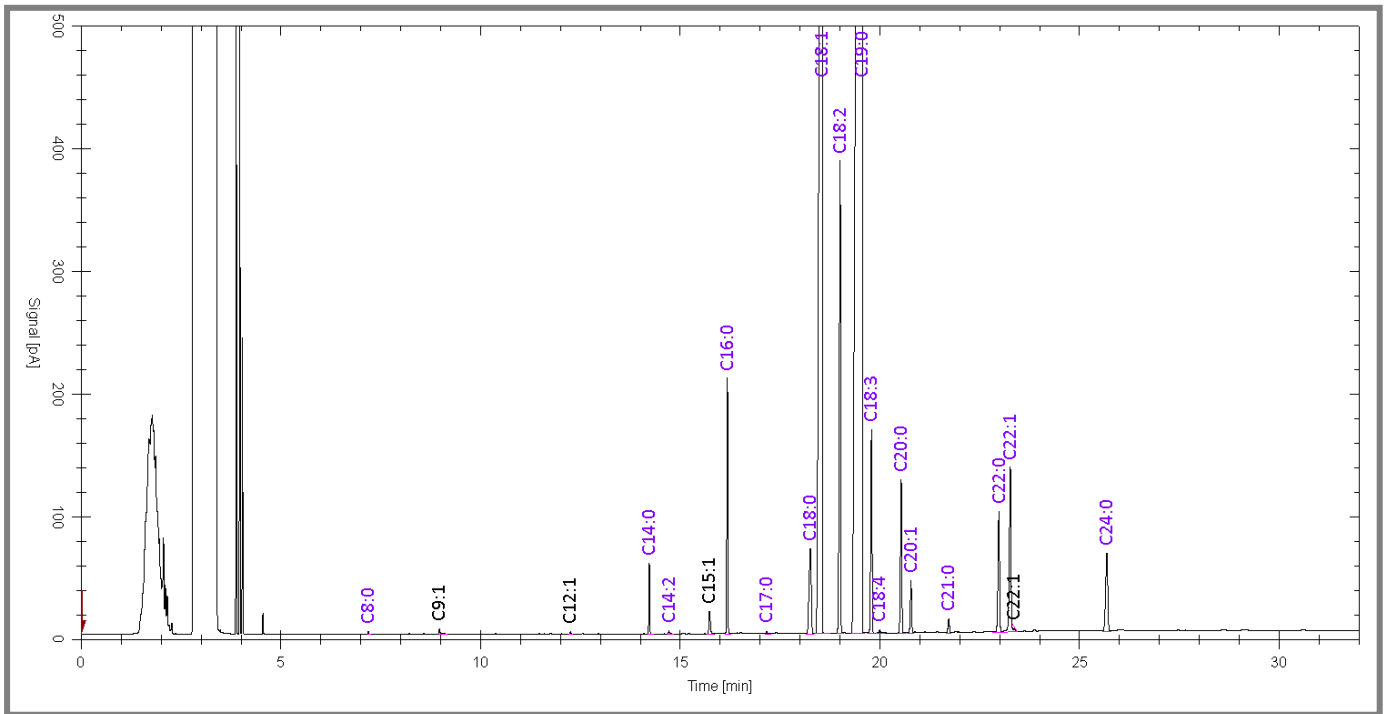


Figure Four: EN14103 analysis by the DVLS Biodiesel Analyzer


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 15-11-29\IF-001-102-BF-RAP ME.D

Sample Preset	Sample
Method	EN14103.M
Analyst	SYSTEM

Peak Report

# Name	Time min.	Index	Area	Conc wt%
1 C8:0	7.203	799.77	2.87E+000	0.034
2 C10:0	8.983	943.34	3.01E+000	0.035
3 C12:0	12.265	1,212.24	2.84E+000	0.033
4 C14:0	14.238	1,396.92	8.22E+001	0.964
5 C14:1	15.742	1,552.89	4.60E+001	0.539
6 C16:0	16.195	1,597.25	3.50E+002	4.106
7 C17:0	17.181	1,696.14	3.93E+000	0.046
8 C18:0	18.275	1,799.59	2.62E+002	3.074
9 C18:1	18.561	1,825.76	5.07E+003	59.471
10 C18:2	19.023	1,867.12	8.85E+002	10.379
11 C19:0	19.575	1,915.36	1.46E+004	0.000
12 C18:3 (3)	19.808	1,935.29	3.75E+002	4.400
13 C18:3 (3)	20.013	1,952.60	5.64E+000	0.066
14 C20:0	20.549	1,997.13	2.87E+002	3.369
15 C20:1 (D5)	20.791	2,017.80	9.79E+001	1.148
16 C20:2	21.738	2,096.75	2.61E+001	0.306
17 C22:0	22.995	2,196.42	2.58E+002	3.026
18 C22:1	23.284	2,218.57	3.78E+002	4.429
19 C24:0	25.698	2,393.50	2.32E+002	2.722

98.148

Groups

Name	Conc wt%
Linolenic Esters	4.47
Ester Content	98.15
Saturated Esters	14.69

Properties

Sample Weight	0.0623 g
ISTD Purity	100.0 g
ISTD Weight	0.1069 g
Iodine Number	85.57 g I / 100 g
Cetane Number	44.2

Figure Five: DVLS PetroReporter EN14103 Report

Factory Tested Application

Each analyzer is tested according to the inhouse testing procedures to check the system performance and to verify the analyzer specification by a reference sample test.

Factory Acceptance Test will be scheduled upon request.

Key Benefits

- Flexible GC configuration dedicated to your application requirements:
 - ✓ EN 14110
 - ✓ EN 14103/EN 15779
 - ✓ EN14105/ASTM D 6584
- High level of automation includes reporting of properties calculation
- Factory tested application

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