



Biodiesel Analyzers

- A family of Comprehensive Solutions

Scion GC Biodiesel Analyzers

Biodiesel is one of the most promising alternative fuel sources available today. Unlike conventional diesel fuel derived from crude oil, biodiesel comes from vegetable oils and animal fats. Compared to petroleum based diesel (petro-diesel), biodiesel is safe, renewable, biodegradable, cleaner burning and is compatible with today's diesel engines. However, like petro-diesel, biodiesel can present a significant analysis challenge.

- Extremely powerful, easy to use analysis solutions. Scion's flexible 456-GC or dual channel single detector 436-GC and compassCDS Chromatography Data Handling Software, combined with a broad range of application optimized columns and consumables provides the analytical power needed to perform all biodiesel analysis methods and ensures that conducting them is simple and straightforward.
- A complete range of GC based biodiesel solutions. Scion offers comprehensive solutions for the analysis of biodiesel by gas chromatography based on 'standard' methods. These include: EN-14105 (free and total glycerol, mono, di and tri-glycerides content), EN-14103 (total FAME and linolenic acid methyl esters), EN14106 (free glycerol), EN-14110 (residual methanol) and ASTM D6584 (free and total glycerin).
- Outstanding multi-channel flexibility of the 456-GC. Depending on your analysis and throughput requirements, two or more standard methods can be accommodated with a single 456-GC system. Both an automated liquid and headspace sampler can be installed on a single 456-GC. It is therefore possible to conduct more than one standard GC analysis method, on a single system without the need for any hardware reconfiguration or lengthy start up/ equilibration times.
- A broad range of application optimized consumables columns specifically designed for biodiesel analysis and long life time. All consumables included in these biodiesel analysis solutions have been carefully selected to ensure both high performance and reliability. Furthermore, a range of high performance capillary columns has been developed specifically for biodiesel applications, including the Scion Biodiesel inert steel column which provides superior separation performance, extremely low phase bleed performance and unequalled column lifetime.
- Single vendor analysis solutions. Scion is proud of its ability to provide a complete solution. All hardware, software, application optimization, documentation, installation and performance verification are provided and supported by Scion, or a trained and authorized Scion dealer.



Figure 1: The 456-GC and compassCDS chromatography workstation team to provide a powerful analysis platform for biodiesel analysis by GC.

● Key Benefits

Introduction

There are a variety of ways to determine biodiesel composition and quality. Both ASTM (American Standard and Testing Methods) and CEN (Comite Europeen de Normalisation) have implemented methods to characterize biodiesel and ensure it conforms to their standard specifications: EN-14214 or ASTM D6751. Of all biodiesel standard methods in use today, those employing GC are the most commonly used. These methods are listed and summarized:

Analysis of Free Glycerine and Total Glycerol; EN-14105, ASTM D6584
 The analysis of glycerine in biodiesel is extremely important because excessive amounts can make long term storage problematic, or cause the formation of unwanted deposits, leading to injector fouling and accelerated engine wear. The analysis of free glycerine and total glycerol requires the use of on-column injection with a high resolution capillary column operated at a very high temperature (>350 °C).

Although there are several factors which can negatively impact the performance of a GC, the most significant associated

Standard Method	Analytes	Injector Type	Recommended GC	Time per Analysis
ASTM D 6584	Free & total Glycerin	On-Column	456-GC or 436-GC	32 mins
EN-14103	Ester & linoleic acid methyl esters	Split / Splitless	456-GC or 436-GC	30 mins
EN-14105	Free and total Glycerin & Mono, Di & Tri-glycerides	On-Column	456-GC or 436-GC	35 mins
EN-14106	Free Glycerol	Split / Splitless	456-GC or 436-GC	10 mins
EN-14110	Methanol	Headspace with Split / Splitless	456-GC or 436-GC	10 mins

Table 1: Overview of Biodiesel methods.

with these particular methods is stress placed on the capillary column as it is subjected to repetitive high temperature thermal cycling of the oven. If conventional fused silica capillary columns are used for either of these methods, a severe reduction in useful column lifetime results. This is due to structural failure of the fused silica column coating itself leading to 'shattering'. To combat this problem, Scion is using a new specifically designed capillary column (Scion Biodiesel). The column is constructed of high tensile strength metal, eliminating the possibility of column failure. Furthermore, the column is extremely easy to install because it has the retention gap pre-coupled and thoroughly leak tested at the factory.

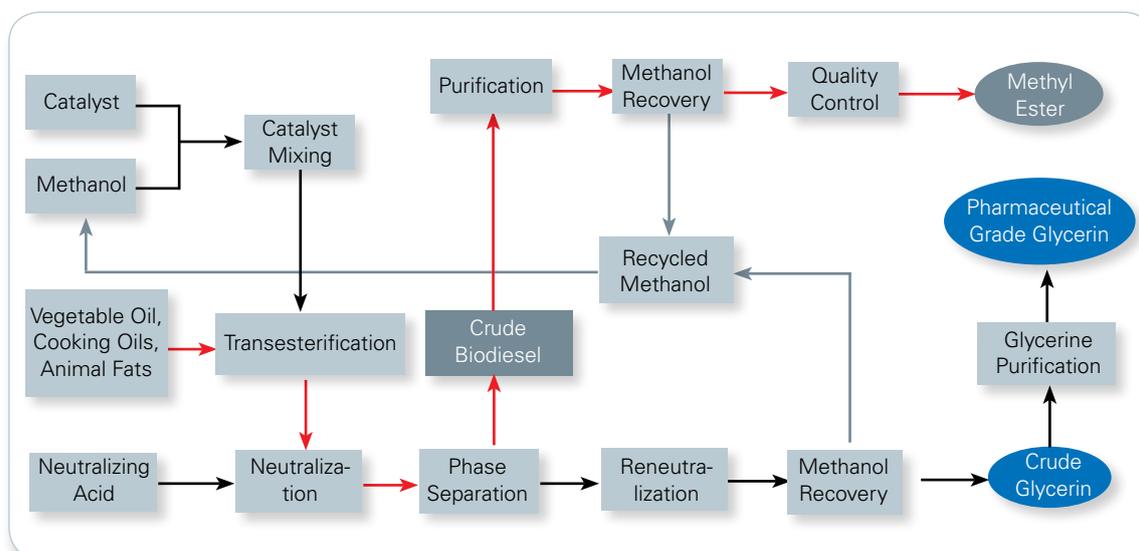


Table 2: Schematic overview of the Biodiesel production process.

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Figure 2. The 456-GC configuration including the SHS-40 headspace sampler and CP-8410 liquid sampler for the analysis three Biodiesel methods.

The Scion Analyzers for Biodiesel are standard configured according each method. This maximizes the flexibility for your analytical needs and ensures maximum analysis capacity.

When several methods are required it is possible to combine these analysis into one GC. With the flexibility of the 456-GC, different methods to analyze biodiesel can be combined. This reduces the amount of equipment required and saves bench space. With the 456-GC, up to three methods (methanol, glycerin and Fames) can be configured using all three GC channels.

Automation is possible with the CP-8400 sampler for dual channel liquid injections in combination with the SHS-40 for the headspace analysis.

The glyceride analysis is used on a dedicated instrument only. The method requires an oven temperature that exceeds the columns' maximum allowed temperature of the other methods.

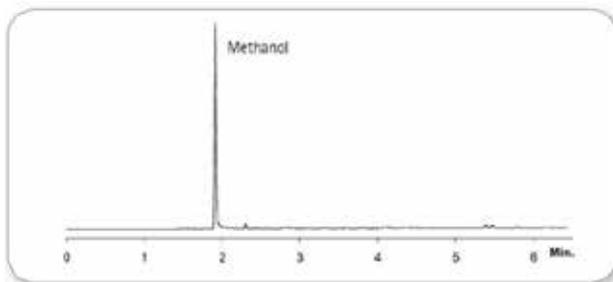


Figure 3. Chromatogram of methanol analysis according to EN-14110: The headspace injection of biodiesel prevents the heavy matrix to be injected onto the column.

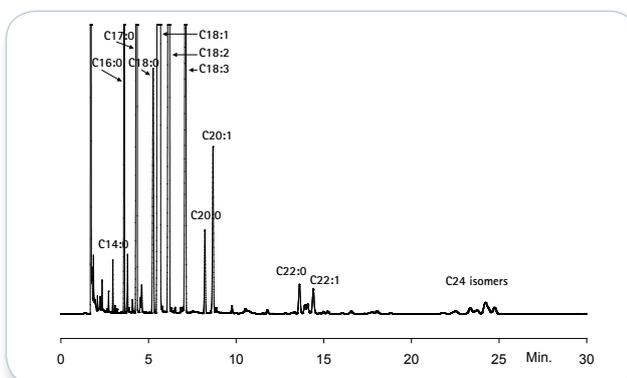


Figure 4. Chromatogram of B-100 biodiesel using the high resolution Scion Biodiesel for FAME column according to EN-14103 to separate the FAME isomers.

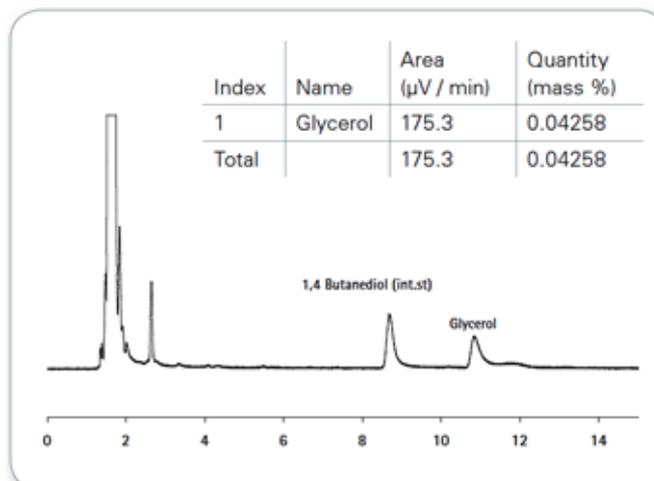


Figure 5. Chromatogram of free glycerol (glycerin) extracted from the biodiesel according ASTM D 6584.

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Figure 6: A two method 436-GC Biodiesel system with SHS-40 headspace sampler and CP-8410 liquid sampler.

With the 436-GC, a combination of methods is available. Using the dual injection single FID configuration in combination at least two analyses (methanol, glycerin or Fames) are merged into the 436-GC. With the SHS-40 headspace sampler and the CP-8400 liquid sampler the system is fully automatable.

Including with the biodiesel analyzers, the powerful compassCDS is available to convert the analysis results into sample data. Especially the total glyceride content according to ASTM D 6584 and EN 14105, is calculated completely within the software by converting the areas of the peaks and peak groups into its glyceride content using the internal standards and glyceride contribution factors. Automatic summation results into the total glyceride content.

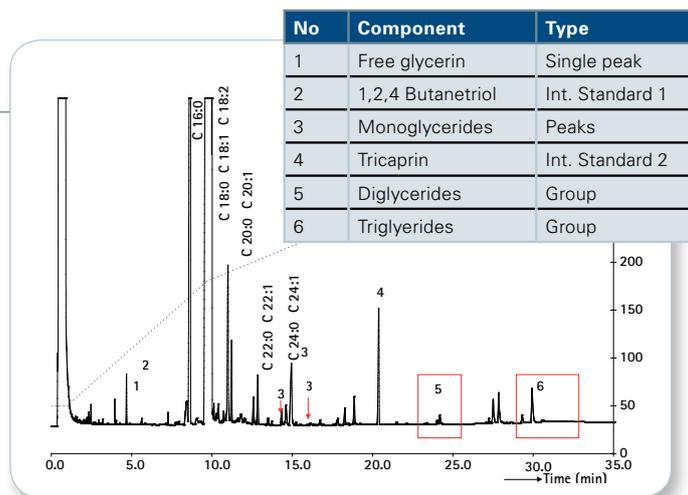


Figure 7: Chromatogram of B-100 biodiesel obtained via EN-14105.

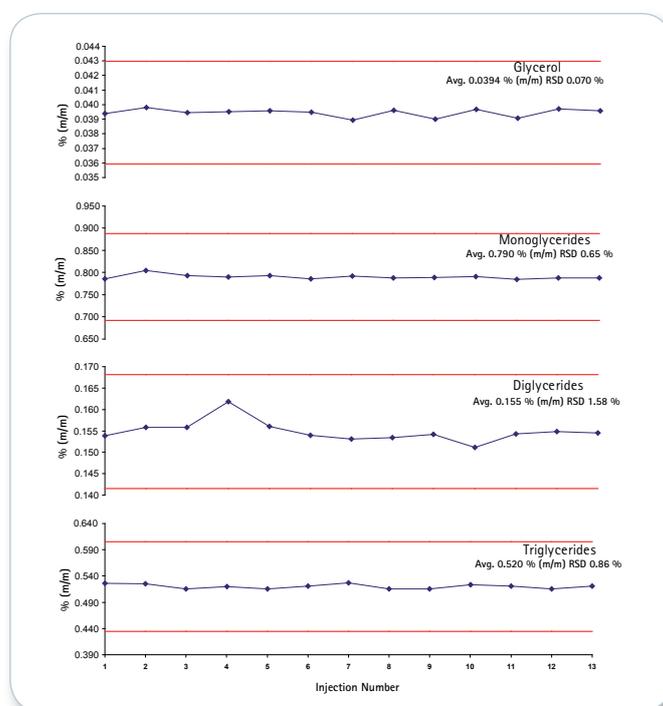


Figure 8: Typical repeatability results of 13 sequential injections of a spiked B-100 biodiesel sample, using the BR-Biodiesel column. Red lines represent the maximum allowed variation per standard method EN-14105.

Description	ASTM D 6584	EN-14103	EN-14105	EN-14106	EN-14110
	Free and total glycerin	Ester and Linoleic acid methyl esters	Free and total glycerin and Mono, Di and Tri-glycerides	Free Glycerol	Methanol
GC Columns					
BR-Biodiesel for Glycerides, 15 m x 0.32 mm x 0.1 µm + 2 m x 0.53 mm ID retention gap	BR29709				
BR-Biodiesel for Glycerides, 15 m x 0.32 mm x 0.1 µm	BR29707				
BR-Biodiesel for Glycerides, 10 m x 0.32 mm x 0.1µm + 2 m x 0.53 mm ID retention gap			BR29710		
BR-Biodiesel for Glycerides, 10 m x 0.32 mm x 0.1µm			BR29708		
BR-SWax for FAME Fused Silica, 30 m x 0.32 mm x 0.25 µm		BR89376			
BR-1 for Methanol Fused Silica, 30 m x 0.32 mm x 3.0 µm					BR89816
BR-Q PLOT, 10 m x 0.32 mm x 10 µm				BR8057-107	

Table 3: Recommended Scion columns.

Scion-Certified Consumables for Your SCION GC Series

Scion GC columns span a broad range of column diameters, stationary phases, and capillary column materials: Fused Silica (FS) and Inert Steel (IS). Ideal for either routine or research type analyses. Scion GC column offerings bridge across many important applications and include a number of offerings such as:

- Standard WCOT (Wall Coated Open Tubular)
- Solid Stationary Phase PLOT (Porous Layer Open Tubular)
- Inert Steel Micro-Packed and Packed



Super Clean™ Gas Filters

Scion Gas Purification Systems have the range to satisfy your needs from individual to combination filters, from Ultra purity combined with Ultra capacity, to all in one solution kits. Innovative features designed into the product yield extensive benefits to the user.

- Ultra-high capacity for long life, less change and improved productivity
- High-purity output ensures 99.9999% Pure Gas
- "Quick connect" fittings for easy, leak-tight filter changes
- Glass internals prevent diffusion; plastic externally for safety
- Easy-to-read indicators for planned maintenance and improved up-time



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