



## Biodiesel Analyzers

- A family of Comprehensive Solutions

# INNOTEK 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. Innoteg's flexible 5000C 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. Innoteg 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 5000C. Depending on your analysis and throughput requirements, two or more standard methods can be accommodated with a single 5000C system. Both an automated liquid and headspace sampler can be installed on a single 5000C. 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 Innoteg Biodiesel inert steel column which provides superior separation performance, extremely low phase bleed performance and unequalled column lifetime.
- Single vendor analysis solutions. Innoteg 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 Innoteg.



**Figure 1:** The 5000C 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:

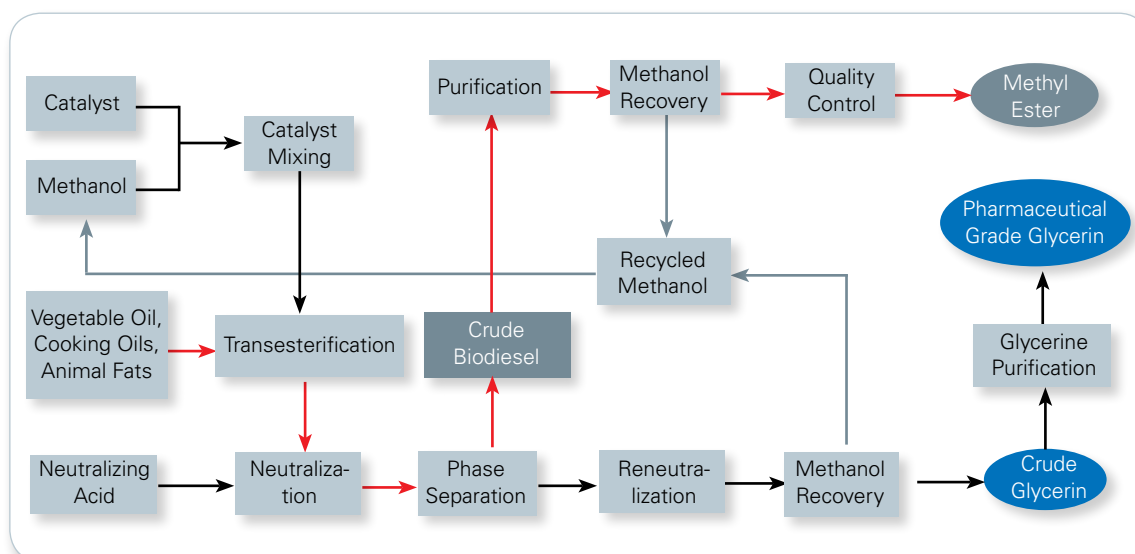
Analysis of Free Glycerine and Total Glycerol; EN-14105, ASTM D6584  
 The analysis of glycerine in biodiesel is extremely important because excessive amounts can make long term storage problematic, or cause the formation of unwanted deposits, leading to injector fouling and accelerated engine wear. 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	5000C	32 mins
EN-14103	Ester & linoleic acid methyl esters	Split / Splitless	5000C	30 mins
EN-14105	Free and total Glycerin & Mono, Di & Tri-glycerides	On-Column	5000C	35 mins
EN-14106	Free Glycerol	Split / Splitless	5000C	10 mins
EN-14110	Methanol	Headspace with Split / Splitless	5000C	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, Innotech is using a new specifically designed capillary column. 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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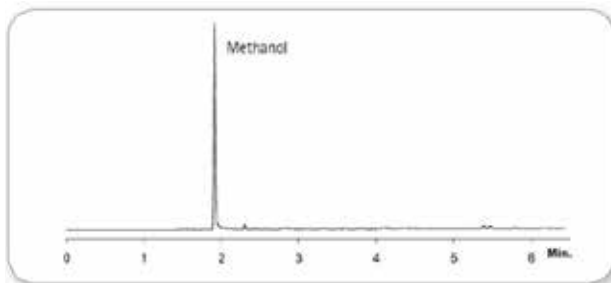
**Figure 2.** The 5000C configuration including CP-8410 liquid sampler for the analysis three Biodiesel methods.

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

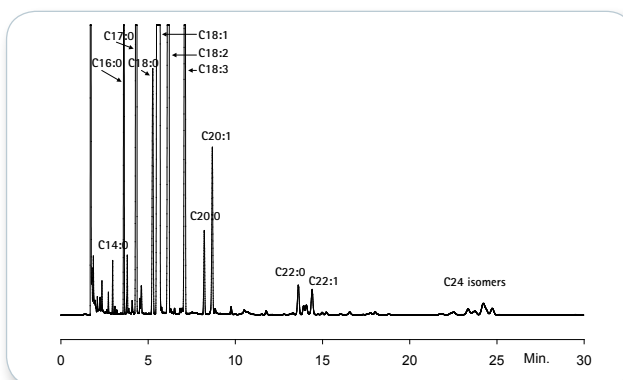
When several methods are required it is possible to combine these analysis into one GC. With the flexibility of the 5000C, different methods to analyze biodiesel can be combined. This reduces the amount of equipment required and saves bench space. With the 5000C, up to three methods (methanol, glycerin and Fames) can be configured using all three GC channels.

Automation is possible with the CP-8400 sampler for dual channel liquid injections .

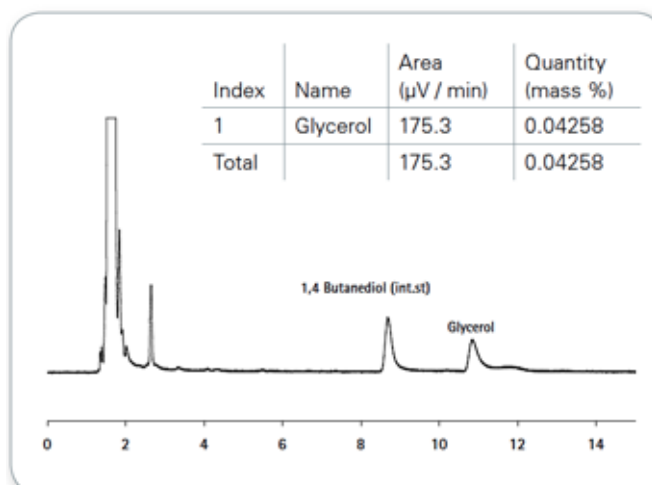
The glyceride analysis is used on a dedicated instrument only. The method requires an oven temperature that exceeds the columns' maximum allowed temperature of the other methods.



**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.